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No. 20

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TECHNOLOGICAL PROGRESS: ACHIEVEMENTS AND PROSPECTS

Moscow PLANOVOYE KHOZYAYSTVO in Russian No 6, June 83 pp 3-13

[Article by D. Zhimerin, first deputy chairman of the State Committee for Science and Engineering, corresponding member of the USSR Academy of Sciences: "Technological Progress: Achievements and Prospects"]

[Text] At all of the stages of economic development technological progress has played a decisive role. Mechanization and automation make it possible to increase labor productivity; new production processes make it possible to decrease the expenditure of material and energy resources. The successful solution of the problem of environmental protection depends upon the realization of scientific and technical achievements. Scientific and technological progress in the production sphere has ensured a leading place for the Soviet Union in the world economy. A vivid testimonial to this is the conquest of outer space, the use of atomic energy for peaceful purposes, and the creation of modern branches of industry.

Overall programs for the most important economic problems are the basis of our state planning of the development of science and technology. During the current 5-year plan, in order to strenthen the influence on the executors of program assignments, use is being made of a new form of control which has given a good account of itself--coordination councils headed by major scientists and ministers or their deputies have been formed for the largest and most difficult programs. During the 10th Five-Year Plan as is known, the programs provided only for the production of experimental consignments of new output. This resulted in the fact that the new equipment models which had been developed and designed were not put in production for a long time and became obsolete. In the programs of the current 5-year plan the assignments for the development of new machines, instruments, and technologies have to be concluded in the series production of output.

The overall programs (and there are more than 170 of them) have been approved by the State Committee for Science and Engineering and Gosplan USSR jointly, and those in which academic scientific organizations participate have also been approved by the USSR Academy of Sciences. They provide for the creation of more than 5,000 new machines, instruments, and materials. In addition, 60 percent of the new equipment assignments are slated to be realized by the end of the 5-year plan.

The total expenditures for the development and series production of new output come to 37 billion rubles, including 14 billion rubles for scientific research and experimental designing work and for the testing of new equipment and technologies under experimental industrial conditions, and 23 billion rubles for the development of the production capacities to master the production of new products; that is, almost two-thirds of the total expenditures. This should be especially emphasized since the opinion is current that if there is scientific development work, the production of new equipment will be ensured. However, even this structure of expenditures is not optimal. Experience demonstrates that in many cases assignments for the series production of new output are not fulfilled because capacities are not ready for it. For this reason, capital expenditures for the modernization and expansion of the production of new equipment have to be even greater than expenditures for its development. Meanwhile, in the annual plans for the economic and social development of a ministry sometimes even the departments of Gosplan USSR violate agreed upon decisions on the allocation of funds for the modernization or expansion of production which has been provided for in the overall programs. A check has established that deviations of this kind represent approximately 15 percent.

The decree of the CPSU Central Committee and USSR Council of Ministers on improving the economic mechanism calls the especial attention of ministries and departments to the necessity for improving the work of all of the elements of the economy and for obtaining a maximum economic effect from the use of new equipment. According to the calculations, the economic effect from the planned amount of the introduction of new equipment will come in 1985 to around 16 billion rubles. On the basis of the other indicator of the effectiveness of new equipment--an increase in labor productivity--around three million workers will conditionally be freed. The performance of the assignments of the overall programs will make it possible to economize in the economy more than 50 million tons of fuel, approximately 14 billion kilowatt-hours of electric energy, and more than 4 million tons of ferrous and nonferrous metals.

The fuel and energy complex is a highly important element of the overall programs. The task has been set of improving its structure, of decreasing the expenditure for energy purposes of liquid fuel, and of increasing the expenditure of hard fuel. Especial attention has been given to an accelerated development of atomic power engineering which will make it possible to fundamentally improve the country's fuel balance.

The USSR's atomic power engineering is growing at rapid rates. Our reactors with a unit capacity of one million kilowatts do not yield to their foreign analogs in their technical and economic indicators. The Ignalina Atomic Electric Power Station with reactors of 1.5 million kilowatts is being successfully built. The stable operations of the atomic electric power stations ensure that they are highly economical. The cost of one kilowatt-hour at an atomic electric power station is less than at thermal electric power stations which operate on hard fuel. In 1982 the Smolensk Atomic Electric Power Station was put into operation.

Great importance is attributed in the overall programs to the indicator of the standard expenditure of fuel per kilowatt-hour of supplied electric energy. Today the USSR's thermal electric power stations surpass those of the United States, the FRG, and England for standard fuel expenditures for the production of electric and thermal energy. However, in 1982 they overexpended one Giga of standard fuel for the production of one kilowatt-hour of electric energy, which led to a total overexpenditure of one million tons.

The Ekibastuz Fuel and Energy Complex is of especial importance. Extremely large coal deposits are concentrated here which are serving as a basis for the construction of thermal electric power stations with energy blocks of 500,000 kilowatts each and with a total capacity of 4 million kilowatts. In the near future they are supposed to transmit electric energy to Kazakhstan, to the Urals, and to the center of the country where a shortage of mineral fuel is being felt. But on account of the unstable operations of the Ekibastuz Hydroelectric Power Station No. 1 the problem of supplying cheap electric energy is being seriously complicated.

The overall program provides for the accelerated creation of a unique electric transmission line with a constant current of 1,500 kilovolts which will ensure the transmission to the European part of the country of up to 48 billion kilowatt-hours of cheap electric energy from the Ekibastuz hydroelectric power stations. For this reason, the USSR Ministry of Energy will have to speed up its construction.

As is known, atomic reactors do not admit of fluctuations in work loads, and large energy blocks which operate on organic fuel are also sensitive to them; in addition, fluctuations entail a decrease in the efficiency of the units. Consequently, the problem of efficiently covering the peaks of electricity work loads (morning and evening) requires a rapid solution. The overall programs provide for its solution by means of the construction of hydro-accumulating hydroelectric power stations and the creation of large-capacity maneuverable energy blocks. But the programs' assignments are not being fulfilled punctually. The USSR Ministry of Energy has dragged out the construction of the Zagorsk Hydro-Accumulating Hydroelectric Power Station with a capacity of 1.2 million kilowatts which is supposed to cover the peak morning and evening work loads, and during the night consume 1.3 million kilowatts from the electric power system, which ensures a more even work load for the atomic electric power stations and large energy blocks of the thermal electric power stations. The Ministry of Power Machine Building is delaying the production of maneuverable energy blocks.

The capacities at the Ekibastuz Thermal Electric Power Station are being mastered slowly, and this is explained to a substantial extent by defects in the boilers, turbines, and auxiliary equipment which is produced by the plants of the Ministry of Power Machine Building and the Ministry of Chemical Machine Building. Designers have created unique and large-capacity energy blocks capable of operating on the basis of the poor quality Ekibastuz coals, but the producers of this equipment are producing it with defects.

For the coal industry the overall programs provide for the introduction of new equipment and for an improvement of operating equipment, for a further mechanization of operations, and for an increase in coal mining by the open pit method. The proportion of this kind of mining in 1982 came to 38.9 percent. In accordance with the programs, a powerful rotary excavator has been created and is being used at the "Bogatyr'" Coal Mine (Ekibastuz); its productivity is 2,500 cubic meters per hour, or twice as much as that of single-scoop excavators. In underground work the proportion of mining with the help of overall mechanized equipment which increase productivity by 1.5-2 times has reached 68.8 percent.

Of fundamental importance is the overall program: "The Development and Mastery of Production Processes and Mining Machinery Systems for the Creation in the Kansko-Achinsk and Other Basins of the Eastern Areas of the Country of Large Capacity Coal Mines With a Labor Productivity Exceeding the Attained Level by Three to Four Times." It provides for the creation of 35 types of equipment and 6 technological schemes for conducting mining operations.

The Kansko-Achinsk basin on whose basis a fuel and energy complex is being formed is unique. In time thermal electric power stations with a total capacity of 34 million kilowatts will go into the Kansko-Achinsk Fuel and Energy Complex. Favorable geological and mining conditions make it possible to work the basin's deposits by the open method with which labor productivity is 10 times greater than with underground mining, and the cost of the coal almost 5 times less. The "Irsha-Borodinskiy" and "Nazarovskiy" Coal Mines are now operating in the basin. In 1982 approximately 37 million tons were mined, or 1.5 times more than in 1975. In 1983 it is planned to mine 40 million tons, in 1985 around 49 million, and by the end of the current century--170-200 million tons.

As a result of the introduction of the new equipment stipulated by the overall program, the average monthly labor productivity of the basin's miners has reached 815 tons compared to an average of 442 tons for open mining enterprises, and the cost of the coal has been cut in half. Compared to 1975, in 1982 the proportion of coal mining involving the use of rotary excavators increased from 22.3 to 70 percent of the total volume. Our country's first super-powerful walking excavator with a bucket capacity of 100 cubic meters and a 100-meter-long crane has been put into operation at the "Nazarovskiy" Mine for stripping operations with the progressive transport-free technology. In a year it moves 12-13 million cubic meters of stripped materials.

In the two years of the 11th Five-Year Plan a number of assignments have been carried out in the creation of new mine transport equipment for the "Berezovskiy" No. 1, "Uryupinskiy" No. 1, "Itatskiy" No. 1, and "Itatskiy" No. 2 Mines. At the first one a pilot model of the ERP-5250 rotary excavator with a capacity of 5,250 cubic meters an hour has been manufactured and is being installed; compared to its predecessor, the ERShRD-5000, it is 850 tons lighter and five percent more productive. The technological preparations have been made and production has been begun on a rotary exca-

vator with the same productivity for the performance of stripping operations. The use of a continuous-action machinery system at the "Berezovskiy" No. 1 Mine will make it possible for the first time in our country to perform stripping operations with a flow-line technology. According to the technical plan, labor productivity in the mining of the coal will come to 2,760 tons a month per worker, or more than three times the average productivity level which has been achieved at the mines of the Kansko-Achinsk Basin.

Along with successes in the realization of the programs, serious shortcomings were revealed. For example, for 1981 the Ministry of Heavy Machine Building had established for it an assignment to produce a walking excavator with a 40-cubic-meter bucket and an 85-meter crane, but this unit had not even been produced in 1982. Its production is planned only in 1985.

The chief direction of the overall programs in mining is further mechanization. Thus, tests have been concluded at the "Yasinovskaya-Glubokaya" Mine in the Donbass on the KM-130 Mechanized Complex for mining coal in steep seams. As a result, labor productivity is being increased by 1.5-2 times and the safety of the work is being ensured. At the same time, mechanization is increasing slowly in the coal industry. There is an especial lagging in the work on overall mechanization and automation.

A special-purpose program for overall coal processing resulting in enriched hard, liquid, and gaseous fuel and chemical products has been devoted to the problem of the development of the Kansko-Achinsk Basin. In this connection the State Scientific Research Power Engineering Institute imeni G. M. Krzhizhanovskiy has developed and carried out at experimental installations a technological energy process for the processing of Kansko-Achinsk coals. Its essence consists in the rapid heating of preliminarily pulverized coal; with it a large part of the moisture (seven-eight percent) is removed from it, and the resin (up to 16 percent of the weight of the substance), fuel gas (up to 6-7 percent) and tar water are separated. The dried and dewatered small grain hard fuel (with an ash and moisture content in the range of six-eight percent) represents a high quality semi-coke with a heat producing capacity of more than 6,000 calories per kilogram.

By using the resin from the semi-coke molded coke can be obtained. Experimental work at a metallurgical plant has proven that it substitutes for ordinary coke. In this way, an extensive opportunity is being created for the replacement of scarce (extracted only in mines) coking coals with open-mined brown coal.

The program provides for the construction at the Krasnoyarsk Heat and Electric Power Station of the large ETKh-175 experimental industrial installation which is capable of processing one million tons of Kansko-Achinsk coal a year. However, the USSR Ministry of Power Engineering has been violating the construction schedules. In addition, the ministry is still performing construction of the first stage in order to obtain semi-coke, resin, and gas which will be burned in the boilers of the heat and electric power station.

The problem of the overall processing and use of the brown coals of the Kansko-Achinsk Basin demands the accelerated construction of the ETKh-175 Installation in full cycle--the obtaining of semi-coke, resin and gas, and tar water and their subsequent processing into end products. At the same time, there should be the simultaneous planning of an industrial combine for the technological energy processing of coals with a capacity of 25-50 million tons of coal a year. The resolution of these issues is within the competence of Gosplan USSR and the USSR Ministry of Power Engineering.

In the petroleum and gas industry the overall programs provide for a further intensification of extraction at operating fields, and for an increase in the use of by-product gas from petroleum extraction and condensate. An increase in petroleum extraction is a very important economic problem. And although it has reached the level of 43 percent (33.3 percent in the United States), the task has been set of bringing it to 50 percent, and in the future to 55-60 percent.

Our petroleum industry occupies advanced positions for the dimensions and diversity of its flooding systems. This has helped to increase the rates of petroleum withdrawal and the degree of its recovery by 1.5-2 times. For example, the recovery level for geological petroleum stocks at the fields of the Urals and Volga without the artificial maintenance of stratum pressure was estimated at 20-30 percent, and with this maintenance at approximately 50 percent. At present around 90 percent of the extractable petroleum is recovered in the Soviet Union with the use of various flooding systems.

The solution of the problem of increasing petroleum yields is carried out by thermal methods (expelling the petroleum by means of gas and hot water, and interior fires), physical and chemical methods (flooding with the addition of various chemical agents and combinations of them), and by the injection of carbon and other gases. During the 11th Five-Year Plan it is planned to increase their use and to create equipment for an intensification of extraction. This will produce a palpable result. Thus, whereas in 1975 1.4 million tons of petroleum was extracted on the basis of new methods, and in 1980--2.7 million tons, in 1985 it is planned to obtain 8 million tons of petroleum. Especial attention is being devoted to the use of new methods at the fields of Western Siberia. It is planned here to introduce flooding with surface-active agents, and to pump alkalides and high pressure hydrocarbon gas. With the help of the new methods during the two years of the current 5-year plan around 6 million tons of petroleum was extracted, compared to an assignment of 5.4 million tons. Successful work is being done by the petroleum extracting enterprises of Kazakhstan, Tatariya, Bashkiriya, and of the Komi ASSR.

There has been a much greater use of new methods of acting upon petroleum strata. In 1982 15 steam generators were installed and put into operation, 7 units for interior burning, 15 furnaces for heating water, and other facilities. In the same year a major experiment was begun on pumping steam

into the deep heavy petroleum stratum of the Usinsk Field (Komi ASSR). Five highly productive steam generators have been installed here, including an experimental one with a productivity of 60 tons of steam per hour under a pressure of 160 atmospheres. Around 70,000 tons of additional petroleum has been extracted on this basis. Construction work is being completed on a complex for pumping carbon dioxide (in combination with flooding) at the Radayevskoye Field in Kuybyshev Oblast. According to calculations, the petroleum yield will increase by approximately 13 percent. A large effect is expected from the introduction of the process of in-situ combustion at field sections with highly viscous petroleum. According to the estimates of specialists, the petroleum yield from the strata will be brought to 53-57 percent. The method of oil displacement by sulphuric acid has become widespread in Tatariya; chemical production waste products are used as agents.

However, not all of the assignments of the overall program for increasing the petroleum yields of strata were fulfilled. For example, at the Samotlorskoye Field in 1982 a high pressure pumping station for the pumping of carbon gas was not put into operation, and the installation was not provided with equipment as a result of the non-fulfillment of contractual deliveries by the enterprises of the Ministry of Chemical and Petroleum Machine Building. The Taganrog Krasnyy Kotel'shchik Plant of the Ministry of Power Machine Building has to accelerate the development and production of powerful high pressure steam generators. The petrochemical industry is in great debt to petroleum workers, since the amount of the production and the composition of the chemical agents is insufficient and is holding back the intensification of petroleum extraction.

In accordance with the overall program, the productive use of by-product gas is gradually increasing. At the present time it comprises more than 76 percent. However, the Ministry of Petroleum Industry is being too slow in carrying out measures for its full use. To this day some of this very valuable energy fuel is being burned up in flares.

The gas extraction industry's rates are increasing. In 1982 500.8 billion cubic meters of natural gas was extracted, or 7.6 percent more than in 1981. This is the result of the realization of a large complex of measures for the development and introduction of new equipment and technology.

Before being transported almost one-half of the extracted gas undergoes preparation at automated installations. And in transporting it ever wider use is being made of computer equipment and automated management systems. In 1982 the Nevskiy Machine Building Plant imeni V. I. Lenin and the Ural Turbine Motor Plant imeni K. Ye. Voroshilov began the series production of new gas pumping units with a capacity of 16,000 and 25,000 kilowatts. Their use is supposed to decrease capital investments by approximately 17 percent and cut compressor station construction schedules almost in half.

In our country gas pipelines are based on pipes with a diameter of 1,420 millimeters and a pressure of 70 atmospheres, compared to the 50 atmospheres previously in use. This is a high level, but the increasing amounts of gas extraction and its transmission to the center of the country and for export is demanding new solutions. For this reason, the overall program provides for measures to increase the gas pressure to 100-120 atmospheres. As a result, with the same pipe diameter (1,420 millimeters) a gas pipeline's carrying capacity will increase by approximately 33 percent. Thus, in order to pump an equal amount of gas instead of three lines, it will be necessary to lay only one. In order to increase the strength of the pipes the Institute of Electric Welding imeni Ye. O. Paton has proposed manufacturing them from multi-layer sheet steel. The production of multi-layer piping has already been mastered at the Vyksa Metallurgical Plant.

The chemical and petrochemical industry has been given the task of improving the quality and increasing the production of polymer materials, plastics, and others. Its successful realization depends to a large extent upon the basic raw materials. The programs stipulate an assignment on accelerating the production of composition materials in which the polymer is taken as a basis, and cheaper materials are used as a filler. The proportion of such fillers can be brought to 90 percent without worsening the quality characteristics made of pure polymers.

The use of cheap and unscarce fillers, in addition to decreasing the cost of final output, will produce a tangible saving of liquid fuel and natural gas. Calculations show that by bringing the annual production of heat insulation materials to 10 million cubic meters and structural materials to 1.5 million tons an economy of 10 million tons of fuel can be obtained. However, the Ministry of the Chemical Industry and the Ministry of the Petrochemical Industry have not been keeping to the established schedules with the assignments of the overall programs for the development and mastery of the production of the necessary materials in the required amounts.

Machine builders have many complaints against metallurgical workers about the quality of the basic materials. The limited assortment of rolled goods compels many branches to overexpend metal, or to expend labor and overload metalworking equipment in order to obtain the shape needed by them. On account of a shortage of sheet metal and the limited shapes rolled goods are replaced by cast parts, which greatly increases the weight of equipment. Powder metallurgy provides a partial solution of this problem. An overall program has been approved for the current 5-year plan which provides for the creation and mastery under industrial conditions of highly productive production processes and equipment for the production of metallic powders, fibers, powder alloys, and refractory compounds, and, on their basis, new materials, coverings, and products. Calculations show that 1 ton of metallic powder replaces 1.5-2 tons of ferrous or nonferrous rolled goods (on the basis of decreasing waste and increasing strength qualities), economizes the labor of 190 machine tool operators, and eliminates the work of 80 metal-cutting machine tools. The total economy from using one ton of powder comes to 1.3-3 million rubles.

At the present time in all of the branches of industry products and semi-finished goods are being used which are obtained by the method of powder metallurgy. In machine building these include structural, friction, ball-bearing, filter, and other products; in electrical engineering, radio engineering, and electronics--contacts, magnets, ferrites, semiconductors, resistors, heating elements, and ferro-electric; in metalworking and in the mining industry--hard and super-hard materials, and powder tools; in aviation, space technology, and nuclear power engineering--heat and corrosion resistant alloys, and heat-protection materials; and in the chemical industry and metallurgy--chemical and heat resistant materials, catalyzers, filters, and refractory materials.

In 1981-1982 a large step forward was taken in the development of powder metallurgy. Capacities for the production of iron and alloy powders and nonferrous metal powders were put into operation at the enterprises of the USSR Ministry of Ferrous Metallurgy and the USSR Ministry of Nonferrous Metallurgy. Shops and sectors have been organized for the production of products made of powders at the plants of the Ministry of Agricultural Machine Building, the Ministry of Machine Building for the Light and Food Industry, and others. The Ministry of Machine Tool Industry has begun to produce new models of specialized presses. The Ministry of Electrical Engineering Industry is completing finishing work on a new type of furnace. The Ministry of Heavy Machine Building has completed the development and begun to produce pilot models of grinding and mixing equipment.

At the same time, there are also serious shortcomings. Thus, the commissioning date for a pulverization shop at the Sulinsk Metallurgical Plant has been postponed for two years. There is a similar picture with the construction of the plants and shops in the Ministry of Machine Tool Industry and the Ministry of Agricultural Machine Building. As a result of the unpreparedness of several enterprises in the Ministry of Electrical Engineering Industry and the Ministry of Communications Industry full use is not being made of copper powders. These ministries have to take urgent measures to eliminate the lagging.

Metal powders will help to solve the problem of protecting metal against corrosion. A special-purpose overall program has set the task of increasing the corrosion resistance of metal by two-three times. More than 200 organizations from 32 ministries are participating in its realization.

In the estimate of specialists, every year around 15 million tons of metal is lost to corrosion. In agriculture, with a total metal fund (in equipment) comprosing 100 million tons, losses reach 700 million rubles. The realization of the anti-corrosion measures mapped out in the program will ensure in 1985 an economy of no less than 40,000 tons of metal, and in value terms approximately 160 million rubles. The process of the plasma spaying of metal powder which has been developed substantially increases the corrosion resistance of metal structures, machines, equipment, and parts. This method, in addition to protection against corrosion, strengthens the surface.

Eighteen overall programs are devoted to the agro-industrial complex. They provide measures to grow new breeds of highly productive livestock; for the development of new methods and means of procuring, processing, and storing feeds for livestock in combination with rational feeding; for an improvement of the system and methods of harvesting, storing, and utilizing agricultural output; and for the modernization of operating and the creation of new highly productive agricultural equipment. Work was done in 1981-1982 on the realization of these measures. However, the planning assignments were not fulfilled in their entirety.

Agricultural workers are making serious complaints against our machine builders. Mechanization specialists are frequently compelled to eliminate serious defects in new equipment. There are many examples in which they put together devices which increase the productivity of the machines and the output harvest. This was the case with the "Niva" grain harvesting combines when attachments made it possible to decrease grain losses. Rubber roofing on the potato harvesting combines has sharply decreased damage to the potatoes and, as a result, there has been a decrease in their losses during storage.

The Ministry of Agricultural Machine Building is holding up the production of a power saturated plowing tractor, and a special rice-harvesting combine has still not been created. The "Niva" combine which has been adapted for this does not provide the necessary harvest, and during threshing the grain is pulverized, which reduces its quality. This is why the ministry has to speed up the production of agricultural machinery and increase its quality and reliability.

Twenty-two state overall programs have been developed for machine building and metal working. In accordance with state and branch programs, during the 11th Five-Year Plan in 11 machine building branches it is planned to master 14,200 items of new output and remove 7,000 obsolete models from production. In 1981-1982 the production was mastered for 6,400 types of new equipment, and 8,500 units of obsolete equipment were removed from production. For 1983 it is planned to master 3,500 units of new equipment, and to remove 1,600 obsolete machines from production.

The composition of these overall programs was preceded by preparatory work carried out in 1980 by the State Committee for Science and Engineering jointly with Gosplan USSR, the USSR Academy of Sciences, and the ministries. Commissions of experts analyzed the technical level and economicalness of around 19,000 different machines, complexes, and instruments. As a result it was established that more than 70 percent of the machine building output corresponded to the world level, while 29 percent had to be removed from production and replaced by new models or modernized. This data was taken into consideration in the overall programs.

In 1981, on the basis of the conclusions of experts from the State Committee for Science and Engineering, it was decided upon and agreed upon with the minis

ministries to remove 1,754 items of obsolete output from production and replace them with new ones. However, only 1,132 units were removed. In 1982 the Ministry of Automotive Industry, the Ministry of Power Engineering Machine Building, the Ministry of Heavy Machine Building, the Ministry of Electrical Engineering Industry, and other ministries also failed to fulfill assignments, removing 63-89 percent of the obsolete equipment from production.

This is giving rise to serious alarm, since in recent years the proportion of newly mastered output has been decreasing with the result that operating equipment is growing obsolete. Thus, during the years 1976-1981 in 11 machine building ministries the proportion of products being produced more than 10 years increased, while the production of output mastered in the course of 3 years decreased.

The ministries regard the reasons for this situation to be a shortage of production and experimental capacities, and of equipment and new materials, and the imperfection of the incentives measures for the development and introduction of new equipment. However, these arguments, with the exception of the shortage of new materials, are invalid.

The planned capacity of many enterprises which were put into operation during the years 1976-1981 are not being made sufficient use of. According to the statistical data, the amount of equipment which is collecting dust in warehouses has been increasing during the past decade.

Full use is not being made of the monies which are allotted for material stimulation for new equipment. References to imperfections in the incentives measures are unconvincing because the 12 July 1979 Decree of the CPSU Central Committee and USSR Council of Ministers provided for additional mark-ups for the production of high quality new output and especially important products.

The universal direction of technological progress is the mechanization and automation of production which brings about a fundamental change in working conditions and an increase in the productivity of social labor. However, the level of mechanization, especially of hoisting and transportations, does not accord with contemporary requirements.

In order to solve this problem an overall program has been worked out for the creation and production of equipment for the mechanization and automation of hoisting and transportation, loading and unloading, and warehouse operations in industry, agriculture, construction, and in transportation. It envisages the creation and introduction in 1981-1985 of 55 new types of hoisting and transportation machines, and the mastery of the series production of 30 of them before the end of the current 5-year plan.

In 1981-1982 the enterprises of the Ministry of Electrical Engineering Industry, the Ministry of Automotive Industry, the Ministry of Construction and Road Machine Building, and the Ministry of Heavy Machine Building mastered

the series production of 14 types of hoisting and transport machines, including 3 types of conveyors with a strength of 450 kilograms, electric bridge cranes with an automated gripping device with a capacity of 8-50 tons, and 2 types of stacker-cranes with a capacity of 2-12.5 tons. Production has been organized for automatic loaders with a side grip for long freight, and of automatic loaders for containers weighing up to 20 tons. One such machine releases 30 people from hard physical labor. At the same time, the enterprises and organizations of the Ministry of Heavy Machine Building and the Ministry of Automotive Industry are lagging in the development of new components for the freight hoisting equipment mapped out in the program for 1983.

During the last decade especial attention has been devoted to shifting from the manual, remote, and mechanical control of machinery and mechanisms or production processes to a system of automated control with the help of electronics. The automation of production processes is developing rapidly. Whereas in the 9th Five-Year Plan 564 automated production processes control systems were created, during the 10th the figure was 1,306, and for the 11th Five-Year Plan it is planned to commission more than 2,700. In 1981-1982 643 of them were put into operation, while at the beginning of 1983 their total number exceeded 2,700. At the same time there are serious shortcomings in their development. These systems are based on controlling computers which are still too expensive and short-lived. The Ministry of Instrument Making and the Ministry of Electrical Engineering Industry will have to take urgent measures to bring the service life of the computers up to the level of the basic equipment.

The production of robots with micro-electronic controls is developing at rapid rates. Robots are being successfully employed in many branches. They are being used for the assembly of watches at three watch plants (Petrodvortsovyy, and the First and Second Moscow Plants), and 267 robots have made it possible to release 425 assemblers. There are 27 automated manipulators at welding, assembling, and other operations at the Moscow Motor Vehicle Plant imeni Likhachev.

The overall program provides for an improvement of the production of robots. Its assignments, and also the state plans for their production are being successfully fulfilled. In 1981-1982 8,710 robots were created, or 30 percent more than the plan. However, the production of robots is outstripping their use. Thus, during the past two years of the 5-year plan only 5,289 units were installed. The ministries and enterprises should take immediate measures to speed up the commissioning of these highly productive mechanisms.

For the time being robots are being developed and used at the initiative of enterprises. There is no interchangability of individual units and, consequently, the conditions have not been created for their cooperative production. The overall program maps out measures for the elimination of this shortcoming.

Electronic equipment is of great importance in solving the problem of automating planning and designing work and speeding up scientific research. With the greater complexity of new equipment and production processes the time for planning and designing work has been increasing: for motor vehicles--up to three-four years; and for chemical production processes as much as five-ten years, and so forth. At the same time, the number of planning and designing personnel has been increasing. The lack of correspondence between the complexity of modern equipment and the obsolete methods of planning and designing it is the objective reason for this.

Definite experience has been gained in the Soviet Union in the automation of planning and designing work. The creation of a system of automated planning and designing work (SAPDW) is most successful in those branches of the economy in which the complexity and rapid replacability of new equipment products makes it necessary to conduct experimental designing work on a high scientific and technical level and as rapidly as possible. For example, a good account was given of themselves by the systems for the designing of asynchronic engines in the All-Union Scientific Research Institute of Electronic Machinery, large electrical machines in the "Elektrosila" Production Association, centrifugal pumps in the All-Union Scientific Research Institute of Hydro-Machine Building, and metal-cutting machine tools in the Ministry of the Instrument Making Industry.

An overall program has been worked out for 1981-1985 for the development of SAPDW in construction. If its assignments are fulfilled a substantial economy can be obtained: approximately 700 million rubles on the basis of decreasing the estimated cost of construction, and a decrease in the expenditure of metal of 700,000 tons, cement--1.3 million tons, and timber materials--500,000 cubic meters.

There are quite a few difficulties in the development of the SAPDW. It is difficult to get complete equipment for the automated systems; there is not organization in the country which provides for the delivery of all of the elements of the SAPDW--from computers and programs to drafting and blueprint multiplication equipment. To the extent of its possibilities, every planning and designing organization plans, collects the equipment, and organizes the system. For this reason, it has become necessary to charge the Ministry of Instrument Making with organizing the centralized development of complete equipment sets for automated systems and of making it responsible for the centralized repair servicing and spare parts supplies for the SAPDW.

In order to create SAPDW large planning and designing organizations need rapid-action computers with no less than one million operations per second and an operational memory of more than 500 kilobytes, and a total one of noeless than 500 megabytes. The systems have to be supplied with external graphic information input and output devices, and screens which enable a dialogue between the planner and designer and the computer. This is the minimum equipment set for the SAPDW. In addition to this, it is also

necessary to begin the production of specific equipment for the SAPDW; this includes sets of jobs, and table computers based on microprocessors.

Computers are being used on a large scale in planning and managing the economy and production and in the sphere of financial activity. At the present time there are 3,963 automated management systems for branches, enterprises, and statistical and financial planning organizations. They have been created in accordance with the directions of the 26th CPSU Congress on a unified technical and industrial basis, which will make it possible in the near future to unite them into a state automated system. The many years of work by the automated management systems has confirmed their great economicalness, and the computations for annual branch and enterprise plans are performed with the help of computers. Successful work is being done by the automated management system of Gosplan USSR and of the union republic Gosplans, and many of the sections of the economic plans are computed on computers and composed automatically. However, the expensive electronic equipment is used 11.1 hours in a 24-hour period, instead of the normative 18 hours. Most of the computer centers of the automated management system are equipped with low productivity computers and an insufficient set of peripheral equipment (discs, displays, rapid printing). As a result, the automated management system is unable to compute multi-variant annual plans, not to mention 5-year plans. The staff of the automated management system is illegitimately large, especially for the servicing of the computer equipment.

Program support for the computers continues to be a bottle-neck. The "Tsentroprogrammsistem" Scientific Production Association which has been created by the Ministry of Instrument Making has done a large amount of work on the centralized formation of programs, and has organized the training of programmists. At the same time, more than half of the organizations which possess systems use their own resources to develop programs. As a result, many of the automated management systems do not have complex programs for the computation of plans, or are provided with low quality ones. The transfer of the electronic equipment and the automated management systems to centralized servicing will have to be speeded up, and this will make it possible to reduce the numbers of computer center personnel (at least twofold) without detriment to the work and to increase the working time of the computers.

The economy has entered the third year of the 11th Five-Year Plan. One of its chief tasks is the elimination of the lagging in the fulfillment of the technological progress program and of other shortcomings in the introduction of scientific and technological achievements.

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IMPROVED MANAGEMENT OF BRANCH RESEARCH AND DESIGN

Moscow PLANOVOYE KHOZYAYSTVO in Russian No 12, Dec 82 pp 46-52

[Article by V. Babak, candidate of economic sciences, V. Logachev, candidate of economic sciences, and V. Novikov, candidate of economic sciences: "An Improvement of the Management of Branch Scientific Research Institutes and Designing Bureaus"]

[Text] An acceleration of scientific and technological progress whose chief results consist above all in increasing labor productivity is at the current stage a highly important task of the country's economic development. One of the ways of accomplishing this task is in the sphere of the management of branch scientific research, planning, and designing organizations. A number of indicators are used to evaluate the results of their work, particularly: the annual economic effect from projects completed in the current year and their effectiveness per ruble of expenditures; the average expenditures per worker in terms of the amount of research performed by the organization itself; and the fulfillment of the labor plan, and also the amount of profits obtained from the fulfillment of contracts with clients.

Let us examine the dynamics of these indicators on the basis of the SRI [Scientific Research Institute] and DB [Designing Bureau] of the Ministry of Chemical Machine Building. The amount of SRDW [Scientific Research and Development Work] which was completed during the 10th Five-Year Plan increased every year and by the end of the plan had risen to 15.7 percent. Incompleted production increased more rapidly, and its growth during the years of the 5-year plan reached 29.2 percent. Beginning with 1978 expenditures increased for halted work and work removed from production. This, undoubtedly, was a reflection of the 1977 shift by this ministry to a cost accounting system of the organization of work on the creation, mastery, and introduction of new equipment on the basis of schedule orders or contracts.

The dynamics of the effectiveness of completed work per ruble of total SRI and DB expenditures will look different: a decrease in it in 1976-1977 was replaced in 1978 by a sharp increase, and, then, there again occurred a substantial decline (to 85.5 percent in 1979 and 84.8 percent in 1980). However, the fluctuations in effectiveness by the years of the 5-year plan do not have any kind of lawful regularity.

During the 10th Five-Year Plan there were substantial differences in the effectiveness of completed work per ruble of the total expenditures of the eight scientific research organizations of the Ministry of Chemical Machine Building (the All-Union Scientific Research and Designing Institute of Chemical Machine Building, the All-Union Scientific Research Designing and Technological Institute of Hydro-Machine Building, the Tatar Scientific Research Institute of Petroleum Machine Building, and others); moreover, these differences were characteristic both of organizations and of years in the same organization. In particular, at the All-Union Scientific Research Designing and Technological Institute of Hydro-Machine Building during individual years this indicator came to from 57.8 to 182.6 percent of the 1975 level; and at the Tatar Scientific Research Institute of Petroleum Machine Building--from 53.4 to 234.4 percent. Even the 5-year-plan average data for each of the institutes fluctuates from 85 to 141.4 percent of the 1975 level.

A study of the dynamics of the average SRI and DB expenditures for a volume of work performed by them per worker also reveals quite sharp annual fluctuations compared to the base level (1975): 102 percent in 1976; 95.8 percent in 1977; 101.7 percent in 1978; 95.4 percent in 1979; and 107.9 percent in 1980. The possibility of using this indicator for planning and evaluating the work of SRI and DB and for strengthening cost accounting gives rise to serious doubts.

Of great importance for such an evaluation is the fulfillment of thematic assignments among which research provided for by the economic plan and the ministry's plan, controlled by superior organizations, and reflected in the reporting is of especial note. The remaining types of work are taken account of as economic contract work in the total number, which makes it possible for organizations to substitute for them and fulfill the plan for the number of assignments while delaying the completion of individual SRDW. According to the data of the annual reports, in 1977 the SRI and DB of the Ministry of Chemical Machine Building did not fulfill only one of the plan topics, while in 1979 they failed to fulfill more than ten. However, with respect to the number of topics the plans were exceeded: in 1977 by 70 percent, and in 1979 by almost 80 percent on the basis of an advanced completion of a corresponding number of SRDW. Moreover, during the 5-year plan the dynamics of the number of topics reveals a definite cyclicity: while in 1976 there occurred a sharp decrease (by more than 25 percent) in their number, in subsequent years it began to increase, and in 1979 the increase in the number of topics and the amount of SRDW rated by estimated cost came to 7.5 percent in relation to the 1975 level. By the end of the 5-year plan the number of topics had increased more rapidly than the amount of SRDW, and in 1980 reached 133.4 percent, while the amount of work came to 115.7 percent.

The plans for the amount of SRDW and for the number of topics were constantly overfulfilled, but in such a way that the former indicator exceeded the latter every year. It is important to emphasize that the planned growth rate of the amount of SRDW was lower than the actual amount every year,

while for the number of topics there was an opposite picture. As a result, there was a change in the average amount of SRDW in rubles per topic which connected the amount and the value of the work performed by the ministry's scientific research and designing organizations. In 1976 this indicator underwent a substantial increase: the efforts of researchers and development workers were concentrated on a limited number of SRDW. However, subsequently it began to decrease and in 1980 came to approximately 84-88 percent.

The indicators of the utilization of the wage fund and of a ceiling on the number of workers occupy an important place in the system of planning and evaluating the work and in the cost accounting of SRI and DB.

There is a close economic interconnection between them and the proportion of SRDW performed by co-executors. Thus, in the SRI and DB of the Ministry of Chemical Machine Building the largest economy of the wage fund through a decrease in the actual number of workers compared to the planned number (by 3.7 percent) was achieved in 1977. Moreover, the proportion of work performed by co-executors was substantially greater than in other years and exceeded the proportion of planned work by 3.3 percent. The annual surplus, in essence, consumed the entire wage fund economy.

The shortcomings of the system of indicators can be revealed from a comparison of the results of the labor of various scientific research organizations. First of all, not all of them are included in the plan, and because of the specific nature of the work of SRI and DB it is impossible to use some of them for this purpose. Secondly, many of the indicators do not always ensure the necessary comparability of results. Thirdly, a large number of them have a very weak influence on the development of cost accounting in the SRI and DB. Thus, the amount not only of the expected but also of the actual economic effect from the performance of scientific and technical measures does not reflect the actual decrease in the cost of output and the additional profits obtained. In addition, the question of with which SRI and DB expenditures an achieved economic effect should be compared in order to determine its amount per ruble of expenditure is still a controversial one.[1]

Note has repeatedly been taken in the economic literature of the weak goal orientation of SRI and DB plans, and of a lack of interest on their part in an economical and most efficient use of resources and allocated capital. Let us observe that it is basically the scientific and technical work of the SRI and DB which is evaluated, and not their economic financial work. In essence, the only plan indicator which is employed in accounting and reporting is the amount of SRDW which is planned with the break-down: on the basis of ЧeFRNT [expansion unknown] and contracts with clients. But in this case only the amount of expenditures for planned (and sometimes unplanned) SRDW is characterized, which provides an impetus toward an increase in the expenditures envisaged by the estimates.

In recent years there has been a movement towards the use of the indicator of SRI and DB output sales. Thus, in the Ministry of Electric Engineering Industry for four years now the SRI and DB of several associations have been receiving payment from clients for fully completed and delivered work. A volume of this kind of work is established for the organizations participating in this experiment during the course of the SRDW planning period. In addition, in accordance with the instructions on transferring branch SRI and DB to the system of payment for work which has been fully completed and accepted by the client, ministries which are shifting to these kinds of payments will have to approve in the 5-year and annual plans of their organizations an indicator of the volume of this kind of work distributed by years and by quarters.

Thus, in the development of the management and of the system of evaluation and of the cost accounting of branch SRI and DB there has been the same process which embraced industrial enterprises during the 8th Five-Year Plan--a shift from planning the production of gross output to planning the volume of output sales. Despite the fact that to this day not a single one of our industrial ministries has completely transferred to payments for delivered SRI and DB output (only individual organizations are being so transferred), on the whole, this procedure should be given a positive evaluation.

The experience connected with employing the output sales indicator to evaluate the work of industrial enterprises has given rise to the necessity for introducing a number of additional indicators, particularly, the punctuality of output deliveries. In addition, the development of cost accounting in the sphere of science and technology as a method of planned economic management on the basis of the commensurability of expenditures and results for the purpose of achieving maximum efficiency not only does not exclude, but presupposes a mandatory consideration of the distinctive characteristics and work conditions of the SRI and DB. However, the indicators being used at the present time do not foster the elimination of negative processes (an increase in incompleted research, an increase in the number of projects being carried out at the same time, and so forth).

The realization of certain proposals will create the conditions for an improvement of the management of scientific research and development in the industrial branches, for reducing the amount of incompleted production, and for concentrating the efforts of development workers on the most important directions of scientific and technological progress. They include, first of all: the development of normative time periods for the performance of SRDW, andoptimization of the network of SRI and DB in the branches, and substantiated nor-setting for the circulating capital of these organizations and providing them with their own circulating capital whose amount is established in percentages of the annual volume of performed SRDW (the remaining amount of work should be covered by bank credit).[2]

On the basis of a study of the work of a number of SRI and DB of six machine building ministries--the Ministry of Electrical Engineering Industry, the

Ministry of Instrument Making, Automation Equipment and Control Systems, the Ministry of Machine Tool and Tool Building Industry, the Ministry of Automotive Industry, the Ministry of Chemical and Petroleum Machine Building, and the Ministry of Machine Building for the Light and Food Industry and Household Appliances,--and also of four ministries which bear the responsibility for the development of the production of final consumption output (mainly consumer goods) and of raw materials--the USSR Ministry of Food Industry, the USSR Ministry of Light Industry, the Ministry of Chemical Industry, and the USSR Ministry of the Coal Industry--a conclusion can be drawn regarding the very great length of the time periods involved in the performance of scientific research which with the majority of the SRI reach five to eight years, and one to two years with designing organizations. Incompleted production with SRI is as much as one-and-one-half to two years worth of performed work, while it is less with designing organizations--approximately 70-80 percent in a year, although with some of them it exceeds even their 2-year plan.

The relationship between performed research, and also the amount of incompleted production, and the amount of expenditures during the same period for work performed and delivered to the client can serve as an important indicator of the efficiency of the expenditure of SRI and DB funds.[3] The differentiation of these indicators for different branches and periods is very substantial. Thus, with the six above machine building industries the relationship of the amount of SRDW performed during a year to the amounts of expenditures during this period for delivered work fluctuated from 88.6 percent (in the Ministry of Automotive Industry in 1975) to 149 percent (in the Ministry of Instrument Making, Automation Equipment and Control Systems in 1974). During individual years in many ministries this amount was less than the amounts of funds written off for delivered work. True, by 1980 these branch differences had decreased appreciably. The amount of SRDW performed during the year in relation to delivered work was: in the Ministry of Electrical Engineering Industry--100.5 percent, in the Ministry of Instrument Making, Automation Equipment and Control Systems--96.6, in the Ministry of Chemical and Petroleum Machine Building--103.5, and in the Ministry of Machine Tool and Tool Building Industry--92.9 percent. As a rule, the largest amount of incompleted SRDW in relation to these expenditures corresponds to the largest surplus. This indicator was the highest in the Ministry of Electrical Engineering Industry--165 percent (toward the end of 1980), while in the Ministry of Chemical and Petroleum Machine Building it was 141 percent, in the Ministry of Instrument Making, Automation Equipment and Control Systems--137.3, and in the Ministry of Machine Tool and Tool Building Industry--only 47.4 percent. In addition, in the latter over a 15-year period (1966-1980) the level of incompleted production did not exceed 80 percent of the funds which had been released for complete research, while in the ministry of Electrical Engineering Industry in 1973 and in the Ministry of Instrument Making in 1974 it reached almost 236 percent.

The dependency relationship between changes in the above magnitudes is quite palpable and obvious. In our view, it will increase with a shift

by branch SRI and DB to payment for work which is fully completed and delivered to the client. During this period especial importance is taken on by the regulation of the relationship between the amount of SRDW performed during the year and the amount of it which is delivered, a regulation which along with bringing order into the writing off of expenditures for halted research should ensure an optimal amount of incompleted production. A decrease in the amount of the latter signifies a corrdsponding economy of funds.

At the present time the relationship between the amount of SRDW completed during a year and the amount of it which is incompleted at the end of the same year has been taking the following form. In the Ministry of Electrical Engineering Industry and the Ministry of Instrument Making--branches in which the financing of SRDW was for a long time carried out with branch funds--the level of incompleted production exceeded the amount of performed SRDW every year and in the 9th and 10th Five-Year Plans rose appreciably. In the other branches this indicator was lower. The process of the outstripping growth of continuing SRDW took place first in the Ministry of Chemical and Petroleum Machine Building, and then included the scientific research and designing organizations of the Ministry of Machine Building for Light Industry and the Ministry of Automotive Industry.

One of the reasons for this situation is in the insufficient interconnection between the cost accounting forms which are employed in connection with the creation, mastery, and introduction of new equipment. The process of preparing for and shifting to the new system began earliest in the Ministry of Electrical Engineering Industry and in the Ministry of Instrument Making. During this period the following shortcomings showed up. Budgetary financing exercised a restraining influence upon the growth of SRDW and of incompleted production. The formation of YeFRNT [expansion unknown] made it possible to increase the amount of financing, and the SRDW plans were fulfilled without regard to the time periods and punctuality of its delivery to clients. Material stimulation in relation to annual economic effect engendered among the SRI and DB workers an endeavour to have as large a reserve stock as possible for the purpose of maneuvering the completion of various projects and increasing allotments to the material incentives funds. Since the amount of incompleted production is not planned, is not normed, and is not considered in evaluating the work of the SRI and DB, there were no direct factors limiting its growth.

The introduction of the amount of work which has been completed, accepted by the client, and paid for as a planning and evaluative indicator for branch SRI and DB could to a definite extent strengthen the tendency which has begun to take shape. For this reason, it is extremely essential to establish not only the amount of this work, but also the number of projects, and to introduce relative indicators as well: the amount of incompleted production per ruble of work which has been delivered and paid for, and the number of incompleted research projects. At the same time, it would be useful to plan the amount and number of SRDW which is being performed during the course of a year.

The amount and number of projects which have been accepted by the client and paid for by him are the basic ones among the proposed indicators. The amounts of the bonuses for SRI and DB workers depend upon their magnitudes. The remaining indicators, which are regarded as supplementary ones, ensure a substantially greater comparability of the results of the work of both individual SRI and DB and of industrial associations and ministries. Economic analysis and financial control with the help of the latter create the cost accounting base for the planned management of research and for the concentration of the efforts of designing and planning workers on a limited number of research projects. In addition, an interconnection between the accounting, analysis, control, and formation of these indicators makes it possible to a certain extent to stimulate, albeit indirectly, a decrease in SRDW time periods.

One of the elements of the cost accounting of branch SRI and DB is the system of economic stimulation, incentives, and bonus payments which makes it possible to interest the collectives and individual workers of scientific research organizations in the fulfillment of plans in accordance with approved indicators. On the whole, the existing bonus practice is determined by a number of documents which establish a unified procedure for the formation and use of the economic stimulation funds, and also the regulated use for bonus payments of additional allotments to the material incentives fund of enterprises with regard to special branch characteristics, and so forth.[4] At the present time a special system of economic stimulation for scientific and technical work is being created which is similar to the one in operation at industrial enterprises. Its basis is made up of the material incentives, social and cultural measures and housing construction, and production development funds which are formed on the basis of the profits that develop at enterprises from a decrease in output costs resulting from the use of scientific and technical innovations; and also from the additional profits included in the wholesale price mark-ups of enterprises for new types of products which are manufactured on the level of the best domestic and foreign models, and certain other sources. In addition, to the basic sources for the formation of the funds, there is a definition of the directions of the use of their monies, the procedure for making incentive payments to workers, and so forth. The model regulation defines the purpose, species, and character of the work for whose performance SRI and DB workers are paid bonuses, and also the procedure for determining the amount and payment of bonuses to the basic categories of these workers (the immediate topic executors, management personnel, and so forth).

It would seem, however, that the formation of the economic stimulation funds and the purposeful use of their monies for bonuses and other types of incentives is insufficiently tied in with the system of indicators which define the cost accounting effectiveness of the work of the SRI and DB which is characterized by a shortening of the production cycle, by the level of SRDW being performed (in percentages of the amount of delivered SRDW), and by the relationship of the amount of incompleted production to the amount of completed research. Meanwhile, the practice of the branch

SRI and DB testifies to the fact that the prolongation of the time periods for the performance and subsequent delivery of work leads to an increase in the differences between the amount of performed and delivered topics and gives rise to a rapid increase in incompleted production.

The existence of such a dependency relationship shows very obviously that with a specific length of the production cycle the amount of delivered work expresses a general real evaluation of the cost accounting work of the SRI and DB. Proceeding from this dependency, it is not difficult to become convinced of the expediency of improving the procedure for forming the economic stimulation funds (particularly, the determination of the amount of allotments to the funds from enterprise and organization profits), and also of the use of their monies for stimulation, incentives, and bonuses.

Without deprecating the virtues of the actual annual economic effect indicator whose magnitude at the present time is the primary determinant for the procedure for forming the economic stimulation funds of research and introduction organizations, and without deprecating the use of monies for stimulation, incentives, and bonuses, it should be pointed out that the former's use does not sufficiently ensure the necessary unity of economic interests in an integral process of the creation, mastery, and introduction of new equipment. To an even lesser extent does its use ensure the achievement of the most important goals of the SRI and DB, and this clearly does not promote a strengthening of cost accounting. For this reason, it is extremely necessary that there be a reflection in accounting reporting of the dynamics of actual economic effect, the process of its formation and use, and also of a comparison of it with the expenditures for the introduction of new equipment.

The basis of the economic stimulation system in effect has to have placed in it concrete, actual, financial and economic indicators which express the characteristic specific branch nature of the work of SRI and DB as independent cost accounting elements capable of making efficient use of the monetary and material resources granted to them and thereby of releasing certain social resources on the basis of curtailing the growth of their amounts as incompleted SRDW production, and of accelerating the turnover rate of the capital which is assigned for the fulfillment of the thematic plan.

Scientific and technological progress is impossible without the carrying out of interconnected measures which promote a large increase in the economic and social effectiveness of scientific research and development work. It is essential to increase the role of SRDW which is performed on the basis of inventions, and also of schedule orders (contracts) in which provision should be made for the full amount of the necessary expenditures, including for the creation of a testing and experimental base. This procedure has been recognized as beneficial in connection with the development of the model regulation on the introduction of schedule orders. The above-mentioned problems--an increase in the effectiveness of the material stimulation system; a strengthening of the goal-directedness of the financing

resources which are designated for the formation and use of the salary and bonus funds of research and development workers; the overcoming of the gap between the formation of funds after the introduction of a concrete development project and the payment of bonuses for the fulfillment of research stages and of plans for the creation of new equipment; a decrease in the fractioning up of the planning topics of scientific organizations to the detriment of the performance of complex development work which is designed for a relatively long period; an increase in the amount of the bonus funds, and others--are connected with the realization of the general principle according to which complex work should be corresponded to by higher pay. An acceleration of the rates of scientific and technological progress is the paramount condition for shifting the economy to intensive means of the expansion of social production. This concerns its leading element--industry--in which the country's basic scientific and technological potential is concentrated at the present moment.

FOOTNOTES

1. This issue is not examined in detail, since it requires special analysis.

2. See: PLANOVOYE KHOZYAYSTVO, No. 10, 1980, pp 70-76.

3. With a certain share of conditionality which reflects the specific nature of the various branches we believe that the expenditures which are written off for performed and delivered work in keeping with estimated and actual cost characterize the amount of SRDW which has been written off during this period.

4. "Regulation on the Procedure for the Formation and Use of the Economic Stimulation Funds in Scientific Research, Designing, Planning and Designing, and Technological Organizations, Production Associations, and at Enterprises Which Have Been Transferred to the Cost Accounting System of the Organization of Work for the Creation, Mastery, and Introduction of New Equipment on the Basis of Schedule Orders (Contracts)" which was approved on 10 April 1980 by the State Committee for Science and Engineering, Gosplan USSR, the USSR State Committee for Labor, the USSR Ministry of Finance, and the AUCCTU; "Standard Regulation on Bonus Payments for Workers of Scientific Research, Designing, Planning and Designing, and Technological Organizations, Production Associations and Enterprises Which Have Been Transferred to the New System of Planning, Financing, and Economic Stimulation for New Equipment Work" which was approved by the USSR State Committee for Labor on 30 January 1978. Corresponding intra-branch documents are worked out and approved with regard to special branch characteristics.

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INCREASED NEW EQUIPMENT PRODUCTION DISCUSSED

Moscow PLANOVOYE KHOZYAYSTVO in Russian No 12, Dec 82 pp 41-46

[Article by Yu. Krotov, deputy subdivision chief at Gosplan USSR: "The Economic Planning Levers for Increasing the Production of New Equipment"]

[Text] An acceleration of the creation, mastery, and introduction into production of the achievements of science and technology is a very important requirement for improving the economic mechanism at the current stage. This is the aim of the 12 July 1979 Decree of the CPSU Central Committee and USSR Council of Ministers.

Measures have been taken to strengthen the interests of enterprises in increasing the production of high quality output. Thus, wholesale price incentive mark-ups are established for new output and products with the State Token of Quality, as are wholesale price discounts for second quality category output; the total of the wholesale price mark-ups and discounts is not considered in the output sales and profits plans, but they are taken into account in evaluating plan fulfillment; and up to 70 percent of the additional profits (the total of the wholesale price mark-ups) which are obtained from the sale of high quality output is used for economic stimulation.

However, these measures do not fully solve the problem. Much, in our view, depends upon the degree of enterprises' interest in expanding the production of new products. Products with the State Token of Quality and other highly effective output are above all new products. The above-mentioned measures to stimulate the production of high quality output eliminate the problem of "profitability" only when it is a matter of the fulfillment of the plan for sales and for profits, and of allotments to the economic stimulation funds. As for other, no less important work indicators (an increase in production and in labor productivity, the return on capital level, the use of the wage fund), with an increase in the production of new output they inevitably worsen. This factor seriously neutralizes the effectiveness of the above measures.

A very important demand which is being made upon the planning and computation of production volumes, labor productivity and return on capital indicators, and others is to ensure their comparability during various periods. This demand is being realized today by means of employing comparable prices and net output normatives. However, the principle of comparability is

realized only in connection with the series production of output, and its action has a stage-by-stage character; that is, it ceases with a movement to new output, and manifests itself again as its production is mastered. Let us explain this with an example.

Let us assume that for several years an enterprise has been producing products A and B: the former for three years, and the latter for two years. Let us accept that at the beginning of production every planned norm-hour of the labor intensiveness of work was matched by two rubles of normative net output (NNO).* By 1982, as a result of an annual increase in labor productivity, the actual labor intensiveness of products A and B has been substantially reduced. In this case, with an invariable normative the output which is accounted for by one norm-hour of "current" labor intensiveness will be: for product A--2.4 rubles, and for product B--2.3 rubles of NNO.

Since 1982 the new product C has been in production with the use of improved equipment and technology. For this reason many of the operations and types of work in keeping with which norm setting and the calculations of labor expenditures are carried out will be less labor intensive than with the production of products A and B. The labor intensiveness of product C has reflected the real achievements of the enterprise collective in the field of improving equipment, technology, and production organization at the moment that the wholesale price and the net output normative are calculated. For the calculation is performed on the basis of real or planned production conditions, and not of the conditions of past years which have been fixed in the prices of the old products A and B. If during previous years, during the process of their production, "processing center" machine tools and those with digital programmed controls had not been introduced, the labor intensiveness of machining the new product C would have been higher. Consequently, the total labor intensiveness of the product would also have been higher than that which is set in its technical calculation.

What has been said in no way means that on the whole the labor intensiveness of the production of new products should be lower than that of the production of old ones. New products, as a rule, are more complex, have more progressive technical characteristics, and can be more labor intensive (per unit). But their labor intensiveness would be even greater if not for the real achievements of previous years in equipment, technology, and production organization.

In 1982 the original (initial) output in the production of a new product which is accounted for by one norm-hour will come to around two rubles of normative net output, just as the case was for products A and B two to three years before. In this connection, product C is less advantageous

*The output per one norm-hour which is obtained by dividing normative net output by the labor intensiveness of the work.

from the point of view of an increase in production volumes, labor productivity, and return on capital, and also from that of planning and evaluating the use of the wage fund.

If it is accepted that in 1981 an enterprise produced only products A and B and that each of them accounted for 50 percent of the total production, then the average output per norm-hour will come to 2.25 rubles of NNO (2.3 x 0.5 + 2.2 x 0.5, where 2.3 and 2.2--are the attained NNO output per norm-hour for the products A and B, respectively; 0.5--is the share of the products A and B in the total NNO). Let us assume that in 1982 the specific values of the products A and B decreased twofold and that product C came to one-half of total production. Then, the average output per norm-hour is equal to 2.16 rubles (2.4 x 0.25 + 2.3 x 0.25 + 2 x 0.5, where 2.4, 2.3, and 2--are output per norm-hour for the products A, B, and C, respectively; 0.25 and 0.5--are the shares of products A, B, and C in total NNO). In this example labor productivity on the whole in 1982, calculated in accordance with the method which has now been adopted, will decrease and come to 96 percent of the 1981 level (2.16:2.25 x 100).

The degree of "decrease" is a result, in essence, not of omissions in the work of the enterprise collective, but of the share of new output in the total amount of production. If the change in output were not so acute as in the given example (the share of new output is not 50 percent, but, let us say, 30 percent), then output production would improve somewhat: on the average, a single norm-hour would account for only 2.25 rubles (2.4 x 0.35 + 2.3 x 0.35 + 2 x 0.3; where 0.35 and 0.3--are the specific values of the products A, B, and C in the total amount of NNO). In this case, labor productivity in 1982 would remain at the 1981 level, despite the fact that in reality it, without question, had increased and would be for products A and B, respectively, 104.3 percent (2.4:2.3 x 100) and 104.5 percent (2.3:2.2 x 100).

It is unrealistic to speak about an increase in labor productivity with the production of product C in 1982 since it did not exist in the previous (base) year. But another thing is also obvious: the productivity of the live labor of the enterprise's workers in the production of this product was no lower than the productivity which had been attained at the enterprise in the previous year; that is, no lower than 2.25 rubles per norm-hour (and not 2 rubles, as follows from the calculations of the net output normative). For all of the achievements of the collective have been taken into account in the technology and organization of the production of the new product C. For this reason, they are also taken into account in the accounting labor intensiveness of the product and in the net output normative which follows from it with the result that these indicators cannot be compared with the corresponding characteristics of products A and B. Their inability to be compared manifests itself especially sharply with the mass and large series production of new products, since the planned conditions of production which are supposed to be achieved in a year or two after the beginning of serious production are reflected in their accounting labor intensiveness. In these cases the real output per norm-hour of actual labor intensiveness will come to around 1.8 rubles.

When labor productivity is measured by commodity output the above problem is insoluble as a result of a purely formal, but fundamental reason: the wholesale prices for new products should reflect the socially necessary labor expenditures which correspond to progressive norms of labor intensiveness which take account of the contemporary level of equipment, technology, and production organization, and also their use value. It is essential that wholesale prices be realistic: there must not be any conventional wholesale prices.

The use of the NNO indicator must also be based on technically substantiated normatives. However, the point of departure must also be that its chief task which becomes especially complicated as a result of a production with an extended products list and the frequent replacement of products is the objective reflection of the dynamic of production volume, labor productivity, and return on capital and of the planning of the wage fund. The net output normatives which are used do not perform financial functions in the cost accounting operations of an enterprise. Their basic purpose is to play the role of a planning and accounting instrument. They have to be sufficiently precise not only for the individual product, but also from the general economic point of view.

The accepted methods of forming the net output normatives directs them only toward an accurate determination of the amount of labor necessary for the production of a concrete product. In estimating an increase in labor productivity this leads to an understatement of output when new products are produced and constantly replaced. It is necessary to develop and experimentally verify other approaches to the establishment of net output normatives. One of the possible variants is set forth below.

The costing magnitude of the labor intensiveness of work, or the basic wages of production workers which correspond to it could be the basis for the computation of a concrete net output normative. In other words, the basis is the same as with the present method of determining normatives. But with this the similarity ends.

In accordance with the presently accepted method, the wages (plus allotments) of the personnel which is engaged in the management and servicing of production, and the normative amount of profits are added to the wages of production workers and the allotments from them for social insurance. This makes it possible to achieve great accuracy in the determination of newly created value under the concrete conditions of current production, but comparability and continuity are lost in the process of estimating the growth of production volume and labor productivity.

In our view, in establishing the net output normative for a new product one should proceed from the amount of labor intensiveness of the work, or from the basic wages of the production workers and move on to the normative by means of making use of the above-mentioned output of normative net output per norm-hour (or per ruble of wages of the production workers).

In accordance with this method, the net output normative for the new product C is calculated on the basis of the following scheme:

the labor intensiveness which is taken into account in the wholesale price costing calculation (150 norm-hours);

the average NNO output per norm-hour with regard to the entire output of the enterprise (according to the report for the year preceding the beginning of the production of the new product, 2.25 rubles/norm-hour);

the net output normative for product C which takes account of the attained level of labor productivity and thereby ensures the comparability of the evaluation of the growth of labor productivity and of production volumes (2.25 rubles/norm-hour x 150 norm-hours = 337.5 rubles).

The method of determining NNO output per unit of labor (one norm-hour of labor intensiveness, or one ruble of the basic wages of production workers) is of fundamental importance. From the point of view of formal positions, it is preferable to make use of NNO output per one ruble of the basic wages of production workers which can be determined by dividing the amount of NNO (Line 03 of Form 8 of the annual report) by the basic wages of production workers (Line 050 of Form 9 of the annual report). If the new product is to be produced at several enterprises, the average branch output per unit of labor will be determined in accordance with the method of calculating average branch magnitudes which is accepted for costing calculations.

The proposed method of establishing net output normatives may encounter objections, since it utilizes only one item of the calculation of the price of a new product--labor intensiveness or the basic wages of production workers,--while the remaining elements of the normative are determined on the basis of consolidated statistical reporting data. A consequence of this will be differences between the real amount of net output which is provided for in the product's price, and the magnitude of the net output normative which is established by the above method.

It would seem, however, that this objection is refuted groundlessly. The NNO indicator is introduced not in order to measure actual newly created value (on a country-wide scale the national income indicator exists for this purpose). Based on elements which reflect newly created value, it serves as an economic instrument which is designed in the first place to evaluate the amount of the work and of the productivity of the live labor of the workers of concrete enterprises, and also a number of other indicators connected with work volume.

The alternatives here consist in the following: either adhere to the accepted method of calculating the net output normatives and thereby lose a part of the growth of NNO and of labor productivity and in this way create difficulties in the conditions connected with the mastery of new products; or take fuller account of the actual dynamics of the above-mentioned indicators and create conditions which are more favorable for the mastery of

new products, but allow a certain deviation from an element-by-element calculation of the net output normatives and establish them in a consolidated manner on the basis of the attained level of labor productivity.

It appears to me that the above-described method for a consolidated calculation of the net output normatives, or one or another modification of it, is capable of solving the problem of strengthening the interest of enterprises in increasing the production of new output. But insofar as society needs not only new but also high quality output, it could be agreed that this method is acceptable in the production only of those products for which incentive wholesale price mark-ups are established, including for the consumer goods index "N."

In those cases when the Token of Quality is awarded and wholesale price incentive mark-ups are given a certain time after the approval of the latter and of the net output normatives, the following procedure is useful:

the net output normative is determined in the ordinary manner, that is, without regard to attained output;

if after the awarding of the Token of Quality the wholesale price is reviewed, the net output normative is reviewed simultaneously. The new normative which has been established by the proposed method, that is, with regard to the attained output, will be higher;

if after the awarding of the Token of Quality the wholesale price is not reviewed and only an incentive mark-up is established, the price setting agencies simultaneously determine a corresponding mark-up for the operative net output normative. In order to simplify its calculation it can be put in the same relation to the normative as the incentive mark-up to the wholesale price.

The increased net output normatives for highly effective output and the mark-ups to them have to be comparable throughout the entire period of the production of the products. If as a result of a deterioration of output quality the Token of Quality is removed from specific products, the enterprise is deprived of the right to an increased net output normative (or the mark-up to it). But the approved NNO volume plan must not be decreased in the current year.

In speaking about an improvement of the economic planning levers which promote an increase in the production of high quality output, let us also note the following. As a result of the distinctive characteristics of concrete productions, the indicator of the proportion of highest quality category output which is used in planning does not embrace all of the branches of industry. In many of them branch output quality indicators are in operation.

The methods instructions on the procedure for planning and economic stimulation are applied only to highest quality category output. How is output

quality planned and stimulated in other branches in which there is no indicator of the proportion of highest quality category output, and is such work done in general? It would seem that this matter is not being controlled to the proper extent by the State Committee for Science and Engineering and Gosplan USSR. A check should be conducted on the state of affairs with the planning and economic stimulation of output quality in all branches of industry.

There is still another important circumstance which has to be mentioned. Today a most acute issue which has not only an economic but also a social and political significance is the issue of actual output quality. There are cases in which products, including those with the Token of Quality, which are manufactured with valuable raw materials and materials are made with poor quality and violations of the technical specifications. For this reason, efforts to improve output quality should be made in the first place not toward increasing the proportion of output with the Token of Quality, but toward the production of all output, including I category output, in accordance with the technical specifications.

The performance of an experiment in the reorganization of the technical control service would be an important measure directed toward improving real output quality. This experiment should be performed on the basis of territory in several oblasts or cities, regardless of the departmental subordination of enterprises, with the exception, perhaps, of special branches which have special output delivery conditions. Its essence would consists of the following. Enterprises are not released from the functions of technical control and responsibility for output quality. However, this control is performed by an enterprise first of all at the preliminary, inter-operational and inter-shop stages of production. The final control (before the delivery of finished output to the warehouse of the sales division) is given to the local agencies of the State Committee for Standards which have been reorganized with respect to their functions and rights. They are given the technical control division workers whose work has been final control from all of the enterprises of a city (oblast), with the appropriate feelings on their numbers and wages. Economic incentives are introduced for the workers of enterprise technical control divisions and of the State Committee for Standards for an improvement of output quality.

In conjunction with the technical control service reorganization experiment it would be useful to charge the State Committee for Standards, with the participation of Gossnab USSR, the USSR Ministry of Trade, the USSR Central Statistical Administration, and the USSR Ministry of Finance, to develop methods instructions on the procedure for exercising control over compliance with quality requirements for all output and for employing sanctions for violations of these requirements. Such methods instructions are presently in operation only for highest quality category output, or for output with incentive price mark-ups. It is clear that this is insufficient, since such products comprise only a part of total industrial production.

The above issues, in our view, are directly related to an improvement of the methodology for planning scientific and technological progress and output quality.

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EQUIPMENT EFFICIENCY, PLANNED PRICES

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[Article by S. M. Yakovlev: "The Efficiency of New Equipment and the Planned Price"]

[Text] During the period of mature socialsm the further improvement of the entire system of production relations occurs for the purpose of the maximum use of the possibilities and advantages of the planned organization of social production. An important direction of the improvement of the economic mechanism consists in the increase of the scientific level of planned pricing and in the enhancement of its role as a factor of the acceleration of the rate of scientific and technical progress. One of the central problems in this area is the dynamics of the wholesale prices for new equipment. The different trends of the change of the prices for new equipment and their correlation with the dynamics of its efficiency have a significant influence on the limits of the use of new equipment in the national economy and on the rate of scientific and technical progress. The materials of the 25th and 26th CPSU Congresses indicate the importance and necessity of the decrease of the level of prices of new equipment per unit of its effective impact. The degree of such a decrease expresses the results of the progress of science and technology in the national economic and is more significant in those sectors and works, in which the efficiency of scientific and technical progress itself is greater.[1] Meanwhile the use of wholesale prices for the stimulation of technical progress, which presumes the increase of labor productivity on the basis of highly efficient equipment and the decrease of production costs, is accompanied in practice by an absolute, and at times a relativel increase of the prices for it and by the absence in some instances of a decrease of the prices for its obsolete types. The appraisal of the causes and consequences of such phenomena in economic literature is dissimilar.

The general laws of the change of value, the prices of new machines and the goods produced by means of them were formulated by K. Marx with reference to capitalism of the period of the implementation of the achievements of the industrial revolution.

Regarding in general form a machine as a means of the saving of embodied labor in the case of the production of the necessary use values, as a means "of the decrease of the cost... and price of commodity, the making of it cheaper, that is, the shortening of the working time necessary for the production of a unit of the

commodity...,"[2] K. Marx in conformity with this approached the question of the dynamics of the value and the prices for new tools of labor. Noting the inevitability of the increase of the weight and value of machines with the development of the productive force of labor, he wrote that this processes is occurring, but not in proportion to the increase of the productive force itself, that is, not in proportion to the increase of the amount of the product, which is yielded by these machines.[3] Although the value of an engine and power tools, as K. Marx noted, is increasing absolutely, it is decreasing relatively as compared with the increasing expansion of production.[4]

Consequently, by the relative decrease of the cost of an absolutely more expensive machine K. Marx understood the change of the ratio of the price and value of the new machine to the increase of the "quantity of products," which are produced by it, or in fact to the increase of labor productivity from the use of the machine, to the decrease of the cost of a unit of the commodity produced by means of the new machine.[5]

Thus, the absolute increase of the cost of new, more efficient tools of labor should naturally be supplemented by the relative decrease of their cost. One common factor--the increase of the effective impact of new machines, which are of higher quality as compared with the operating machines and are capable of meeting a greater social need--is the basis for these interconnected processes. The social use value does not influence directly the amount of the value, which is determined by the socially necessary expenditures of labor. The latter change under the influence of the increase of the productivity of national labor. However, the increase of the effective impact of a new machine to the extent of the increase of its productivity, while making it possible to meet a great amount of the social need, in fact signifies the increase of the amount of the use values, which were produced at the same time, that is, the increase of the individual labor productivity. The increased use value of a new machine (which is equivalent to several use values of conventional machines) appears as the result of a higher individual labor productivity and embodies a greater amount of social value.

Consequently, a new highly productive machine is in fact the result of a greater individual labor productivity, while a greater amount of social value is embodied in it. Then a smaller value and price with respect to a unit of the need, which is met by this machine, accompany the greater value and price of the new machine. The price for the new machine, which is set with allowance made for its increased use value, while reflecting the dynamics of the social value, should decrease with the expansion of its production and the decrease of the amount of the value as a result of obsolescence. The amount of the relative decrease of the prices for new tools of labor depends on the efficiency of the latter as compared with the assimilated tools of labor and on the level at which the wholesale price will the set with respect to the social value of the new tools of labor.

The process of the decrease of the cost of new tools of labor as the effective impact of their use increases has peculiarities at the different stages of scientific and technical progress and depends on the degree of novelty of the equipment and the prevailing form of production relations. The specific nature of the relative decrease of the cost of new equipment under socialism is connected with the planned nature of this process, as well as with the development of the content and forms of the effective impact which is provided by the machines.

With reference to the early stages of technical progress the effective impact of the use of machines--the saving of embodied labor--was accomplished by the direct decrease of the cost of the goods being produced by means of them. K. Marx linked the relative decrease of the cost of new machines with the correlation of their value and the increase of productivity, characterizing the more efficient machines as "cheaper as compared with the amounts of their work."[6]

Under socialism not only were the limits of the saving by the machine of national labor (living and embodied, paid and unpaid) extended, but the forms of the effective impact of machines became more diverse.[7] Machines are produced not only for the purpose of the saving of embodied labor when producing the necessary products, but also for the improvement of working conditions, the development of the creative nature of labor and so on. The increase of the consumer properties of new equipment, while frequently signifying an increase of the aggregate effective socioeconomic impact for a unified association of workers, does not always reduce to the saving of national labor, while the latter does not always find expression in the decrease of the cost of a unit of the commodity which is produced by means of it.

The broadening of the forms of the effective impact of the tools of labor under the conditions of the stage of scientific and technical progress makes its measurement difficult. It is often difficult to express the effective impact quantitatively (the improvement of working conditions, the increase of labor safety techniques and other forms of the social and ecological impact). At times it is manifested not in production itself, but in the sphere of the ultimate consumption of the product which was produced by the given machines (for example, especially precise instruments).[8] The accomplishment of the scientific and technical tasks, to which the scientific and technical revolution is giving rise, is bringing about the need for the development of fundamentally new machines, which do not fit within the conventional framework of the current value estimation, while being at the same time an enormous potential effective impact in the future.

The diversity of the forms of the effective impact of new equipment and the certain difficult of its accurate and complete determination for socialist society were responsible, in our opinion, for the lack of a clear and unambiguous understanding in economic literature of the content of the relative decrease and increase of the cost of new tools of labor.

V. Gal'perin, for example, believes that the lead of the increase of the value of new machines as compared with their productivity (and capacity), which is manifested in the increase of the capital intensiveness of the increase of the volume of output (as compared with the use of the assimilated machines), represents the relative increase of the cost of new equipment for society.[9] Yu. Borozdin and other economists believe that the increase of the specific value (price) of machines per unit of a separately taken parameter (productivity, capacity and so on) does not imply the relative increase of the cost of new equipment, since here the entire "aggregate effective impact" of the use of the new machine as compared with the base machine, particularly the saving of operating costs, is not taken into account.[10] In the opinion of M. Gabrieli, the real economic effectiveness of new equipment can be established only within an economic complex, which includes all the units of the division and cooperation of labor for the meeting of a given social need, while "the cost of the meeting of the ultimate need" as a result of scientific and technical progress should not increase. He proposed to elaborate its standard.[11]

In our opinion, the relative decrease of the cost of new equipment per unit of the effective impact occurs if the increase of its aggregate effective impact surpasses the increase of its value and price in case of the conformity of the structure of the effective impact itself to the socially necessary structure. The point is that the structure of the factors of the aggregate effective impact of new equipment is nonuniform. The latter can be achieved by the improvement of the various technical and economic parameters of the equipment (its productivity, capacity, reliability, durability and so on), which leads to the economy of the current and one-time expenditures of national labor and to the increase of the social impact in various forms and proportions. It does make a difference to society, by the increase of what factors and at what cost the aggregate effective impact of new equipment increases. At each given moment the socially necessary proportion between the increase of the various factors of the aggregate effective impact and the increase of the expenditures which ensure it objectively exists in the national economy.

On the basis of the foregoing it is possible to distinguish in the structure of the aggregate effective impact the primary and the derivative effective impacts of new equipment. There should be understood by the former the direct saving of national labor from the use of new machines, by the latter--its use for the achievement of the social effective impact.

The increase of the effective impact of equipment in the form of the social impact is a characteristic trait of socialism as a higher stage of the development of social production. However, one must not forget the material basis of the social impact. The latter in the end reflects the achieved level of development of the productive forces and the efficiency of social production. The increase of the aggregate effective impact of new equipment by the increase of the social impact presumes a primary effective impact and should not, as a rule, be accomplished by the decrease of the latter. In case of the long-term effect of the tendency toward the increase of the national economic impact of new equipment by means of the increase of primarily its social impact a situation can arise, when the material bases of the long-term increase of the latter will be weakened. Such a process can complicate the decrease of the amounts of national labor, which are embodied in the means of production, and will limit the possibilities of the expansion of production and the use of the surplus product for the increase of the well-being and the meeting of the social needs of the members of social. What has been said by not means denies the importance of the increase of the social impact of new equipment and the need for its reflection in prices. The main difficulty lies in the precise determination of the objectively necessary amount of the increase of the social effective impact and the expenditures responsible for it.

It is necessary to maintain the optimum structure of the primary effective impact. The greatest increase of the efficiency of social production can be achieved, if in the structure of the primary effective impact of new equipment there dominates, as a rule, the increase of its productivity and capacity, which ensures a saving of one-time and current expenditures, and not the increase of the technical and economic parameters which cause only a saving of future operating expenses. In the former case the introduction of a new machine promotes a reduction of the cost of the products produced by means of it and a decrease of the capital-output ratio of these products; in the latter case the cost of the products may decrease, but the capital-output ratio increases here. Society is interested in the simultaneous decrease of the cost and capital-output ratio of products, which ensures the greatest

saving of national labor and creates an opportunity to increase the share of the surplus product which is used directly for social needs.

The further embodiment of the requirement on the decrease of the level of prices of new equipment per unit of its effective impact, which was formulated at the 25th and 26th CPSU Congresses, should be achieved by the more precise determination of the amount and structure of the actual national economic impact of the new equipment and the improvement of the methods of its reflection in the prices.

The trends appearing in the setting of prices for new equipment confirm, in our opinion, the importance of the precise determination and maintenance of the objectively necessary structure of the effective impact of new equipment. As N. T. Glushkov noted, the analysis of the prices for new equipment in machine building during 1976-1978 showed that "the indicators, which characterize indirectly, not directly the social productivity of new types of machines and equipment, account for the greater portion of the effective impact of new equipment. On the average for machine building in 1977-1978 in the structure of the effective impact the indicators of the saving due to the annual productivity came to 10-15 percent, the durability (reliability)--another 10-15 percent, while the current operating expenses--70-80 percent, that is, only up to 30 percent of the increase of the cost of new equipment is due to its specific improvement."[12] Here it is important to consider that it is often simpler and more profitable for the producers to increase the nonbasic operating parameters of new equipment than to achieve an increase of the capacity or productivity of equipment, and that neither the producers nor the users bear responsibility for the validity of the calculations on the economy of current expenditures, while the change of these technical parameters is not recorded in the standards. All this leads to a significant overstatement of the calculated impact of the new equipment as compared with its actual national economic efficiency and, as a consequence of the latter, also frequently to the relative increase of the specific value and price of the new equipment. The latter, while implying an increase of the capital intensiveness and capital-output ratio of the products being produced, can be covered by the saving of current expenditures for the national economy as a whole. However, this process is occurring more and more slowly.[13]

Some economists link the tendency for the wholesale prices for new equipment to increase with the consideration in the ratio of prices of the quality and other consumer properties of the product, with the need to ensure a profitability for every normally operating enterprise, that is, with the changes in the system of planned pricing, which have occurred since the revision of prices in 1967 in connection with the economic reform.[14] Obviously, this exists. However, the tendencies for an absolute and relative increase of the prices for new equipment were also noted earlier.[15] The reasons here in a number of instances were different: in particular, the lack of precise criteria of the determination of the efficiency of new equipment and the permissible expenditures on its assimilation and the setting of temporary prices frequently led to the overstatement of the wholesale prices and so on.

These facts testify that the wholesale price is still not fully performing the role of the planning standard, an economic tool of the regulation of the limits of the use of new equipment under socialism. The increase of the cost of new equipment is connected not with the reflection of its efficiency in the planned prices, but,

among other reasons, with the still inadequately precise reliable consideration in the planned prices of the actual national economic impact of the new equipment and with the inadequate efficiency, in some instances, of the new equipment itself.

It is possible to distinguish, in our opinion, several types of the relative increase of the cost of new equipment: according to the form of accomplishment--open and concealed, according to the content--partial and complete. In practice they all are frequently interconnected, but the causes, importance, consequences and possible means of overcoming them are different.

The open relative increase of the cost of new equipment is the most noticeable with respect to the form of accomplishment: the increase of its value surpasses the increase of the most important technical and economic parameters (productivity, capacity and so on).[16] The concealed form of the relative increase of the cost is becoming more and more prevalent. In this case although the increase of the estimated, probable effective impact of the new equipment exceeds the increase of its price, it is accompanied by a smaller increase of the actual effective impact as a result of the objective impossibility of using in the national economy all its technical and economic properties. The incomplete utilization in consumption of the technical and economic parameters of new equipment, which found reflection in the prices for it, in our opinion, is equivalent to the relative increase of its cost both for the user and often also for the entire national economy to the extent to which the increase of prices is not offset by an increase of the actual economic impact of consumption.

Both the objective process of the acceleration of scientific and technical progress and the distinction of its levels in different sectors and the increase of the consumer properties of new equipment without an adequate interconnection with the qualitative and the quantitative structures of social needs serve as prerequisites of the existence of the "relatively excessive" technical potential of new tools of labor.[17] It seems that the frequent instances of the increase of the quality of new equipment and its stimulation by prices without regard for the real need are also becoming a consequence of the underestimation of this requirement.

It is possible, obviously, to agree with the claims of economists that to a certain extent the lead of the increase of the technical potential of new equipment is a phenomenon which is natural for scientific and technical progress. It stems from the fact that the rate of development of science and technology, which has internal laws, leads their realization in economic practice.[18] However, this should apply to a greater extent to new equipment, the total economic impact of which can be expressed in the future and today still cannot be accurately calculated and, hence, reflected in the prices. This assumption applies to a smaller extent to new equipment which is already known, but is still not very widespread and is liable to extensive introduction in the national economy.

The concealed relative increase of the cost of new equipment occurs when the actual impact of its use is less than the calculated impact, which is determined in accordance with the technical data of the new equipment, when the increase of the effective impact of an individual machine or a component assembly is not supplemented by an increase of the specific effective impact of the systems of machines or a complete set of equipment, as well as if it is being used everywhere, while its effective impact can be utilized completely only in limited spheres of use. The

latter is considerably widespread. Thus, the completeness and efficiency of the use of the technical parameters of general-purpose screw-cutting machines with the changeover in industry from small-series production of specialized, large-series production decrease. Such high technical indicators of the general-purpose machine tools as the power, speed, precision and roughness of the machining of parts are not being completely utilized. The even more modern 1-K-20 general-purpose machine tool, among the improved indicators of which there were also those which were not utilized completely in the old model, was produced during the improvement of the model of the 1-K-62 general-purpose machine tool. As a result the capacity of the machine tool increased by 20 percent, while the price increased by 2.5-fold. The old model was subsequently removed from production, the users are forced to purchase the new model, even if its efficient use in the given sphere of application is impossible.[19]

The possible increase of the cost of equipment with obsolescence can be assigned to the form of the concealed relative increase of its cost. Scientific and technical progress, while expediting the process of the updating and the increase of the quality of equipment, at the same time shortens the period of its obsolescence and intensifies the tendency for the value of the tools of labor, which are becoming obsolete, to decrease. With the maintenance of a unchanged level of prices for the latter they increase relatively in price, the profitability of the production of obsolete products rises, the interest of enterprises in continuing their production increases. Since the prices for new equipment are set with reference to the level of the prices for the equipment which is being replaced and is obsolete, the groundless increase of the prices of the new equipment itself is possible. With the last revision of the wholesale prices and rates in industry, starting in 1982, steps on the decrease of the profitability of such products were envisaged. This will promote the more active removal from production of obsolete types of equipment and will prevent the relative increase of its cost.

The relative increase of the cost of equipment can occur in different forms at all the stages of its life cycle: at the stage of designing, assimilation (the excessive drawing out or the groundless increase of the expenditures of assimilation),[20] production (the enterprises are not always interested to a sufficient extent in the decrease of the prices for new equipment as its production is assimilated; instances of deviation from the established standards and the actual worsening of the quality of the products being produced while keeping unchanged the wholesale price set for it are encountered). The relative increase of the cost of new equipment, which occurs as a result of this, can promote to a significant extent the tendency for the level of wholesale prices in the processing sectors to increase and can slow the implementation of the achievements of scientific and technical progress in other spheres of the national economy.

The consequences of the relative increase of the cost of new equipment depends on the extent to which they affect all the components of the effective impact of the new equipment. If the increase of the price per unit of the most important technical and economic parameters of the equipment is accompanied by a decrease of the current operating costs of its use, there is only a partial relative increase of the cost. If the increase of the unit prices is not accompanied by a substantial saving of current expenses or an increase of the social impact, the total increase of the cost of the new equipment per unit of effective impact occurs.[21] The consequences of these types of the relative changes of prices are different: whereas

in the former case an increase of the specific capital-output ratio of the final product with a possible decrease of its value (although without fail to a smaller extent due to the "counteraction" of the increasing share of embodied labor) directly occurs, in the latter an increase of the value of the goods being produced is possible. Moreover, the increase of the unit prices of the new equipment can be accompanied by a decrease of the total amount of the aggregate expenditures of labor on its production and use per unit of the effective impact. This gives reason to deny entirely the relative increase of the cost of new equipment, when the increase of the unit prices is offset by a decrease of the current expenditures.

However, the offsetting of the increase of the unit prices of new equipment per unit of its productivity by the saving of future operating expenses has definite limits: not simply the exceeding of the increase of the saving by the user as compared with the increase of the expenditures on the production of this equipment is necessary, but a specific extent of such an excess is important. In general the increase of the unit prices (the capital-output ratio) of new equipment cannot always be completely offset by the saving of current expenditures. The latter would not encounter difficulties, if the amount of the total fund of capital investments of society was not limited.[22] Although society is also interested in the decrease of the total expenditures of labor (living and embodied), owing to the limited possibilities during each specific historical period of development it is forced to "standardize" the degree of the offsetting by the saving of current expenditures of the increase of the one-time resources which have been diverted for capital investments. Society sets the least permissible ratio between the saving of current expenditures and the increase of the one-time capital expenditures which caused this saving. In economic practice the standard coefficient of efficiency, the value of which depends, on the one hand, on the availability of assets, which can be allocated by society for capital investments, and, on the other, on the need of society for them, performs this function. If the increase of capital investments is covered by the saving of current expenditures within the limits of the standard payback period, the one-time diversion of resources (other conditions being equal) from the point of view of society can be justified.

In planned pricing the use of the principle of the "social comparison" of the possibility of the saving of current expenditures and the increase of capital investments has special features. The prices for new equipment with allowance made for its effective impact as compared with the equipment being replaced are determined for each type regardless of each other. If the unit value of the most important technical and economic parameters of the new equipment increased with the simultaneous saving of operating expenses, from the point of view of the resumption and expansion of the process of production the total capital-output ratio of the products being produced by means of it can increase.

For an increase of an identical amount of the final product in the case of the use of new equipment with a higher unit price the user needs more one-time capital expenditures than in the case of the use of the equipment being replaced. This actually presumes the unlimitedness of the fund of capital investments in the sector to which this equipment is being sent, since the possibility of an increase of the specific capital-output ratio of all types of new equipment is not ruled out. If we rule out the possibility of an increase of the fund of capital investments of every sector at the expense of the aggregate national economic fund (it is also limited), the making up of the necessary capital investments in the sector is

partially possible only by means of the increase of the share of accumulation in the price by either the sharp decrease of the production cost of the products being produced or the increase of prices. For example, the increase of the unit value is occurring for a significant amount of the equipment which is being produced for agriculture.[23] The question of the sources for covering the increase of the specific capital-output ratio of this new equipment is arising. The increase of the production cost of agricultural products can occur to the extent to which this increase reaches agriculture.[24]

The analysis of the relative decrease and increase of the cost of new equipment per unit of its ultimate effective impact testifies to the dissimilar role of the factors of the increase of the effective impact in the relative decrease of the cost of new equipment for society. The increase of the productivity of new equipment, which surpasses the increase of its value, leads to a decrease of the production cost, the value and the capital-output ratio of products in society. It promotes to the greatest extent the saving of national labor and the increase of the efficiency and intensity of social production. The increase of the technical and economic parameters of new equipment, which ensures a saving of future current expenditures, promotes a decrease of the production cost and, under specific conditions, the value of products. However, the capital-output ratio of the latter will increase.

The process of the increase of the capital-output ratio of products in itself can reflect the objective trends and stages of the maturity of scientific and technical progress. In particular, in the case of the replacement of manual labor by mechanized labor or in the case of the substitution of more perfect machines for less perfect ones with an increase of the capital-output ratio the production efficiency may increase, although not at the fastest rate. However, the increase of the prices for new equipment can artificially stimulate the increase of the capital-output ratio of products to a greater extent than the increase of its productivity. As a result the efficiency and the rate of scientific and technical progress itself may decrease; a smaller saving of national labor in the national economy may be provided; the proportion of accumulation may increase, while the proportion of consumption may decrease; the increase of the proportion of the surplus product, which is used for meeting social needs, may be complicated. In addition to this, the disturbance of the balance between the physical and value proportions of the national economy is possible.

Consequently, it is necessary for the relative decrease of the cost of new equipment, as its effective impact increases, to be backed not only by the saving of current expenditures, but first of all by the increase of the main technical and economic parameters (productivity, capacity and so on), which will ensure to the greatest extent the implementation of the achievements of of scientific and technical progress in the national economy.

The improvement of the methods of determining the real economic impact from the use of new equipment as compared with the equipment being replaced and its reflection in the prices, as well as the finding of more precise methods of estimating the relative increase of the cost of new products will be a most important condition of the successful accomplishment of the task of the relative decrease of the cost of new equipment. The monitoring of the relative decrease of the cost of new equipment should serve as a hindrance to the penetration into the national economy

of inefficient items and should promote the elimination of the tendency to overstate the economic impact in the wholesale prices of new products as compared with the actual impact of their use. It is necessary for the evaluation of the relative decrease of the cost of new equipment not to be an external factor with respect to the wholesale price being drawn up, but to be one of the features of its substantiation.

The consideration of the effective impact of new equipment when determining the upper limit of the price requires further improvement. The calculation of the effective impact according to the prevailing method, in our opinion, does not adequately direct attention to the relative decrease of the cost of new equipment, which promotes the maximum saving of aggregate national labor.[25] Here the equivalence of the increase of all the components of the aggregate effective impact is presumed. The decrease of operating expenses and the change of the specific capital investments as a result of the increase of productivity are regarded as having a uniform economic importance for the user and for the national economy, with respect to the proportion and the amount of the permissible additional expenditures on their increase. The formula, in accordance with which the calculation is made, while reflecting the composition of the components of the effective impact for the user when using the new equipment, does not determine the optimum structure of the increase of the factors of this effective impact and the increase of the expenditures which cause it.

The calculation of the upper limit of the price according to the indicated formula, in case of which the old and new equipment with different specific capital expenditures is considered equally profitable, in our opinion, contains the possibility of an increase of the expenditures on the new equipment without an increase of its main technical and economic parameters (productivity and so on) and does not stimulate adequately the saving of capital expenditures in the national economy. The moment when the upper limit of the price increases mainly due to the saving of expenditures, and not due to the increase of the productivity of the equipment, is not taken into account in this calculation, then this means (on the condition that the upper limit of the price exceeds the lower limit) that as a result of the introduction of new equipment the overall efficiency may increase, while the capital-output ratio decreases. Obviously, there is an objective ratio between the increase of these two components of the effective impact, in case of which the output-capital ratio will also increase. In our opinion, it is advisable in the case of the calculation of the efficiency for the determination of the upper limit of the price for new equipment not to take into account the saving of the operating expenses of the user, which forms as a result of the increase of the most important technical and economic parameters of this equipment (productivity, capacity). The same additional expenditures of the producer, which ensure the increase of the most important parameters of the new equipment and thereby have already been taken into account when determining the price, are the basis for this saving.

Thus, the assurance of the relative decrease of the cost of new equipment is possible on the basis of the further increase of the efficiency of scientific and technical progress itself, the improvement of the reflection in the prices for new tools of labor of the actual, real national economic impact of the new equipment, the increase of the role of the wholesale price in the relative decrease of the cost of a new product at all the stages of its life cycle: from the designing to the removal from production of an obsolete product. The relative decrease of the cost of

new equipment per unit of the effective impact will promote the broadening of the sphere of the implementation of the achievements of scientific and technical progress in the national economy and the increase of the efficiency and the growth rate of all social production.

FOOTNOTES

1. Thus, according to the calculations of A. G. Gogoberidze, the decrease of the value of a unit of the effective impact for the new products of machine building came in 1976 to 33 percent, 1977--28 percent, 1978--33.5 percent, 1979--36.6 percent (see A. G. Gogoberidze, "The Stimulation of Technical Progress and the Increase of the Quality of the Products of Machine Building by Means of Prices," "Materialy Vsesoyuznogo soveshcheniya po voprosam tsenoobrazovaniya" [Materials of the All-Union Conference on Questions of Pricing], Moscow, 1981, p 217).

2. K. Marx and F. Engels, "Soch." [Works], Vol 47, p 351.

3. K. Marx and F. Engels, "Soch.," Vol 25, Part I, p 121.

4. Ibid., p 94.

5. "By the RELATIVE [in italics] decrease of the cost of machines I understand such a state of affairs, when the absolute value of the mass of machines, which is being used, increases, but not to the extent to which the mass of these machines and their efficiency increase" (K. Marx and F. Engels, "Soch.," Vol 26, Part III, p 228).

6. K. Marx and F. Engels, "Soch.," Vol 23, p 619.

7. V. Loginov and A. Matlin distinguish four basic forms of the effective impact of new machines: the increase of the output of products, the increase of the quality of the products being produced, the saving of expenditures in the use of the equipment for the user, the social impact. In the end these forms of the effective impact promote the saving of national labor and the effect of the basic economic law of socialism (see V. Loginov, A. Matlin, "The Determination of the Efficiency of New Equipment," VOPROSY EKONOMIKI, No 4, 1975, p 126).

8. It is possible in practice of resolve these difficulties, in the opinion of some economists, by having learned to determine the main parameter of product quality (the integral indicator), which reveals more completely the aggregate effective impact of new equipment ("Izmereniye kachestva produktsii" [The Measurement of Product Quality], edited by A. V. Glichev, Moscow, 1971, p 12). Under present conditions the amount of the effective impact is determined in value form in terms of the change of the economic impact, which arises during the use of a new machine in the national economy.

9. See V. Gal'perin, "The Efficiency and Prices of New Equipment," VOPROSY EKONOMIKI, No 3, 1977, p 14.

10. "Usileniye roli tsen v stimulirovanii nauchno-tekhnicheskogo progressa i povysheniya kachestva sredstv proizvodstva" [The Enhancement of the Role of Prices in the Stimulation of Scientific and Technical Progress and the Increase of the Quality of Means of Production], Moscow, 1975, p 50; Yu. Yakovets, "The Interrelationship of Quality and Price Under the Conditions of the Scientific and Technical Revolution," PLANOVOYE KHOZYAYSTVO, No 11, 1973, p 72; A. Koshuta, "An Up-to-Date Model of the Price for New Equipment," VOPROSY EKONOMIKI, No 7, 1973, p 7; Yu. V. Borozdin, G. M. Korostelkin, T. E. Egert, "Methodological Questions of the Improvement of the Prices for the Products of Machine Building," IZVESTIYA AKADEMII NAUK SSSR. SERIYA EKONOMICHESKAYA, No 6, 1974, p 47.

11. See M. Gabrieli, "The Scientific and Technical Revolution and the Development of Planned Pricing," "60 let planovogo tsenoobrazovaniya v SSSR" [60 Years of Planned Pricing in the USSR], Moscow, 1979, p 129.

12. N. T. Glushkov, "60 Years of Planned Pricing in the USSR and the Basic Tasks of the Improvement of the System of Prices in Light of the Decisions of the 25th CPSU Congress," "60 let planovogo tsenoobrazovaniya v SSSR," p 25.

13. See T. S. Khachaturov, "The Means of Increasing the Effectiveness of Capital Investments," VOPROSY EKONOMIKI, No 7, 1979, p 124.

14. See B. M. Kosminskiy, "Sebestoimost' v planovom tsenoobrazovanii" [The Production Cost in Planned Pricing], Moscow, 1972, p 23; B. Plyshevskiy, "Production Efficiency and the Price," VOPROSY EKONOMIKI, No 2, 1981, p 20.

15. "Tekhnicheskiy progress i planovoye tsenoobrazovaniye v SSSR [Technical Progress and Planned Pricing in the USSR], Moscow, 1967, pp 22, 23.

16. Thus, N. P Fedorenko, while comparing several new automatic machine tools with program control with the machine tools being replaced, noted that in the case of the increase of the prices for them respectively for different models by 6.5-, 14.7-, 9.7-, 3.5- and 10-fold the productivity increased respectively by only 4-, 9-, 5-, 2.7- and 7-fold ("Nekotoryye voprosy teorii i praktiki planirovaniya i upravleniya" [Some Questions of the Theory and Practice of Planning and Management], Moscow, 1979, p 309).

17. K. N. Plotnikov and A. S. Gusarov directed attention to the need and importance of the stimulation by prices of the achievement of the socially necessary level of the quality of new equipment with allowance made for the aggregate expenditures of society on the meeting of the aggregate social need (see K. N. Plotnikov, A. S. Gusarov, "Sovremennyye problemy teorii i praktiki tsenoobrazovaniya pri sotsializme" [Modern Problems of the Theory and Practice of Pricing Under Socialism], Moscow, 1971, pp 306-316).

18. See A. Koshuta, L. Rozenova, "New Equipment and the Interest of Enterprises in Its Assimilation," VOPROSY EKONOMIKI, No 8, 1974, p 49.

19. See T. O. Volkova, "On the Role of Prices in the Increase of the Efficiency of New Equipment," VOPROSY TSENOOBRAZOVANIYA, No 7, 1976. According to her data, approximately 50 percent of the new machine tools are not being used in the optimum sphere of their application, that is, their technical potentials are not being completely realized.

20. See N. T. Glushkov, "The Economic Mechanism and the Practice of Planned Pricing," KOMMUNIST, No 8, 1980, p 48.

21. Thus, "the price of a unit of effective impact of the means of production, which are being delivered from industry, increased significantly.... The traditional 'horsepower,' the unit of power with a loop of the necessary machines, increased in the price for kolkhozes and sovkhozes on the average by 1.7-fold, the price of a unit of active substance in mineral fertilizers increased by approximately 20 percent, and a unit of mixed fodders--nearly twofold. As a result the material expenditures of kolkhozes and sovkhozes per unit of output during 1966-1976 increased by 77 percent" (PRAVDA, 4 August 1978, p 3).

22. See A. N. Komin, "Problemy planovogo tsenoobrazovaniya" [The Problems of Planned Pricing], Moscow, 1971, p 170; V. Gal'perin, "The Efficiency and Prices of New Equipment," VOPROSY EKONOMIKI, No 3, 1977, pp 10-17.

23. The prices for the basic types of means of production, which were delivered to agriculture during 1965-1975, increased on the average by 35 percent. Of the total increase of the prices for tractors and agricultural machinery a little more than two-thirds can be attributed to the increase of productivity, while the remainder can be attributed to other factors of the effective impact, which might not have an influence on the decrease of the expenditures for the production of agricultural products ("Tezisy dokladov Vsesoyuznoy sessii Mezhduvedomstvennogo nauchnogo soveta po problemam tsenoobrazovaniya. M., 13-14 noyab., 1979" [Heads of the Reports of the All-Union Session of the Interdepartment Scientific Council for the Problems of Pricing. Moscow, 13-14 November 1979], Moscow, 1980, p 6).

24. "According to calculations... three-fourths of the increase of the product cost, which has occurred in recent times at the kolkhozes of the Ukrainian SSR, was due to the increase of the cost and the incompleteness of the deliveries of tools and objects of labor to agriculture" (ibid., p 23).

25. "Metodika opredeleniya optovykh tsen na novuyu produktsiyu proizvodstvenno-tekhnicheskogo naznacheniya" [The Method of Determining the Wholesale Prices for New Products for Production Engineering Purposes], Moscow, 1974. A new method, in which these questions were settled in part, was approved during the period of the preparation of the article (EKONOMICHESKAYA GAZETA, No 6, February 1983).

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SCIENTIFIC, TECHNICAL PROGRESS DEFINED

Moscow VESTNIK MOSKOVSKOGO UNIVERSITETA, SERIYA 6. EKONOMIKA in Russian No 3, Mar 83 (manuscript received 29 Apr 80) pp 48-57

[Article by B. M. Smirnov: "On the Essence and Motive Forces of Scientific and Technical Progress"]

[Text] The study of the essence and motive forces of scientific and technical progress under socialism constitutes in conformity with the methodology of Marxism a necessary starting point for the solution of a large number of most important problems of the socialist economy, including the diverse problems of speeding up the processes of developing and introducing new equipment. In the end the law of the conformity of production relations to the level and nature of the development of the productive forces of society, which under the conditions of socialism is the basis for the planned improvement of all the elements of the economic mechanism, finds its expression in this.

As to the question of the essence of scientific and technical progress, it should first of all be noted that in economic literature many different definitions of it are cited.[1] In some works scientific and technical progress is defined as the development of scientific knowledge, equipment, technology, the organization of labor or only the means of labor,[2] in others it is defined as the process of the origination and practical use of scientific and technical achievements, the successive realization of the stages of the development and introduction of new equipment,[3] in still others--as the basic sphere of activity of enterprises, which is connected with the increase of their technical level and the assimilation of new products and differs from their operation under the conditions of organized production.[4] Undoubtedly, all these concepts are of definite scientific importance, but their common drawback, in our opinion, consists in the fact that in them the essence of scientific and technical progress is identified either with the various forms of its manifestation or with individual components of its specific content. Thus, in the first case the essence of scientific and technical progress is identified with one or several of its directions; in the second--with its stages or phases within the "research--production" cycle; in the third--with its peculiarities as compared with the current activity of enterprises. As a result the essence of scientific and technical progress is expressed incompletely, narrowly.

The definitions of scientific and technical progress from the point of view of the changes occurring in the forms of the link of science with production, as well as the basic elements of the productive forces: man and the means of labor, seem more

correct. L. M. Gatovskiy, for example, understands by scientific and technical progress "the processes of the constant technical, economically efficient updating of production, the development and mastering for this of new knowledge...."[5] G. S. Gudozhnik characterizes scientific and technical progress as an objective sequence of scientific discoveries and inventions and the transfer of production functions from man to equipment.[6] V. N. Cherkovets links scientific and technical progress with "the radical changes which are occurring with the role of labor and man in the direct process of production."[7]

However, in spite of the positive content, definitions of this sort are frequently of a very general nature, which decreases the possibility of their use as a basis for the analysis and the accomplishment of specific tasks on the improvement of the mechanism of the acceleration of scientific and technical progress.

A broad interpretation of scientific and technical progress, in conformity with which it is defined as "the continuous improvement of all the aspects of social production,"[8] while "all the aspects and elements of physical production--the productive forces and production relations"[9] are included in its content, also occurs in economic literature. Obviously, in this case scientific and technical progress is identified with the development of the mode of social production as a whole, which it is hardly possible to recognize as legitimate.

The idea that scientific and technical progress is an economic category, while its essence is inseparable from the production relations and economic laws of society,[10] is also among the typical but, in our opinion, erroneous ideas.

Many authors when defining scientific and technical progress characterize it only from the point of view of the purposeful, subjective activity of people, which is carried out for the meeting of needs, and leave aside such most important features of it as objectivity, regularity and historical conditionality. The objectivity of the motive forces of scientific and technical progress is thereby also concealed.

And finally, many definitions of scientific and technical progress, which exist in economic literature, are formulated without regard for the basic logical method of constructing any concept through the indication of its immediate origin (a broader concept) and specific distinction. "What does it mean to give a 'definition'? This means, first of all, to place a given concept under another, broader one," V. I. Lenin noted.[11]

Marx's theory of productive forces, which consists, in our opinion, first, in the division of their development into periods subject to the nature of the interaction of equipment and manpower in a specific labor process, second, in the determination of the conditions of the natural appearance and increase of the role of science in the development of social production and, third, in the substantiation of the need for the analysis of the development of the productive forces from the point of view of their influence on the socioeconomic results of production, is the basis of the definition of the essence of scientific and technical progress. This last thing, however, does not signify the identification of scientific and technical progress with production relations and its definition as an economic category. The development of science and technology is regarded by K. Marx first of all as a means of increasing the productive force of labor and decreasing production costs.[12] It is

necessary to distinguish (of course, not to separate entirely) this attribute of scientific and technical progress from the socioeconomic conditions of the use of science and technology.

The complete definition of scientific and technical progress is inseparably connected with the identification of the peculiarities of the stages of development of the productive forces, which succeed each other in conformity with certain laws. Thus, simple and general-purpose implements of production are the material basis of the craft industry, while the labor of the handicraft worker includes, as a rule, all the production functions: direct action on the object of labor; the movement and shifting of the means of production; space and time coordination or the control of all the components of the process; monitoring. The improvement of the technology of the craft industry and the achievement of the best effective result with the least expenditures are achieved exclusively by experimentation.

The manufacturing period is characterized by the isolation of the different labor operations, their attachment to home workers and the specialization of the means of labor. Precisely this specific form of the development of productive forces was the material prerequisite of the development of machines. However, handicraft remains the basis of manufactory. The production process as before is governed entirely by the strength, dexterity and skillfulness of each individual worker and only to a negligible extent by the perfection of the means of labor. "This narrow technical base," K. Marx writes, "excludes the possibility of a truly scientific breakdown of the production process."[13] Such a possibility arises only with the transition from manufactory to large-scale industry, when the transformation of the tools of labor into machines occurs. The development of the power tool commenced the gradual transfer of production functions from man to tools of labor and thereby the industrial revolution. The production process begins to be freed of the limitations characteristic of manpower and acquires a form of movement, which is more and more dependent on it and is governed by the internal laws of the development of technology. This brought about the need for the appearance of technical sciences and attested to the appearance in the system of social production of the first scientific and technical elements.

The productive forces underwent further development during the period of large-scale industry. The development of the engine and the transfer to it of the function of movement, which was previously performed by the worker, were the consummation of the industrial revolution of the 18th and 19th centuries. "As a machine," K. Marx writes, "the means of labor acquires such a material form of existence, which is responsible for the replacement of manpower by the forces of nature and empirical routine methods by the conscious application of natural science."[14]

Hence it follows that under the conditions of mechanical engineering the need and the possibility of the technological application of science acquire for the first time the form of an objective law of the improvement of the process of labor and physical production as a whole. The effect of this law is especially increasing during the present period, which is characterized by a new qualitative leap in the development of productive forces--the scientific and technical revolution. It expresses the transition to the automation of production or the transfer of the functions of control and monitoring to means of labor, as well as the intensive fusing of science with production.

Thus, the gradual transfer of production functions from man to machine, which expresses the essence of the development of productive forces and technical progress, is accompanied by two interconnected processes. On the one hand, by the appearance and the increase of the role of a new element of the development of productive forces--science as a necessary condition of the further development of technology, and, on the other, by the radical change of the content of labor as a result of its mechanization and automation.

At the same time the specification of the most essential traits of scientific and technical progress would be incomplete without an indication of its socioeconomic importance. K. Marx examined the development of technology precisely from such a point of view, indicating that the economic results and limits of its use depend not only on its ability to decrease the expenditures on the production of products, but also on the social conditions of production.[15]

Under socialism the limits of the use of technology are extended to the amounts of its national economic efficiency, which creates the conditions for the obtaining of more significant results of the progress of science and technology than under capitalism.

Generalizing what has been said, it is possible to define scientific and technical progress under socialism as a natural historical stage of the development of productive forces, in case of which all of its components are involved in the social production process as a result of the use of advanced achievements of science, while scientific and technical activity itself is a necessary condition of the replacement of living labor by new equipment, the continuous updating of production and the increase on this basis of its national economic efficiency. As is evident, this definition characterizes scientific and technical progress from the point of view of its three most essential attributes. The first of them is the objective need itself for the use of the achievements of science in modern production, which is characterized by the increase of the indicators of its science-intensiveness. By determining and analyzing these indicators (for example, the ratio of the expenditures on scientific research and experimental design work to the volume of the production of output) and by comparing them by sectors of industry with the analogous indicators of countries which are developed scientifically and technically, it is possible to evaluate the degree of the need of modern production for scientific research and the level of scientific and technical progress with respect to this most important attribute of it. At the same time, in order to obtain in this case a more complete picture, it is necessary to compare the dynamics of the science-intensiveness of production and the efficiency of scientific research and experimental design work. Here, in our opinion, the leading growth of the latter should be considered natural. The mechanism of the control of scientific and technical progress should be aimed at precisely such a type of development of scientific research and experimental design work.

The second attribute consists in the qualitative change of the interaction of manpower and equipment in the process of labor and in the increase of the level of its mechanization and automation. In recent years an intensive process of the development and introduction of new equipment has been under way in our country. At the same time the bulk of the enterprises are still at the stage of incomplete mechanization, which is characterized by a significant scale of manual labor. This attests to the need for the acceleration of the rate of the complete mechanization of

production as the most important and for today the most effective direction of scientific and technical progress for the majority of enterprises and sectors.

The third, generalizing attribute of scientific and technical progress is characterized by its efficiency, which under present conditions acts as the main component and determines the dynamics of the efficiency of socialist production as a whole. Precisely for this reason the efficiency of scientific and technical progress should act as the basis of the evaluation of the efficiency of production activity at the different levels of management. However, at present this latter is examined and evaluated to a considerable extent in isolation of the impact of scientific and technical progress, which, in turn, has considerable autonomy in the system of indicators of efficiency, which it is impossible to recognize as sound. "The efficiency of scientific and technical progress," as L. S. Blyakhman correctly notes, "is a component of the efficiency of production, and not a complement to it; the efficiency of science is manifested in the efficiency of the use of production resources, and does not exist alongside it."[16] Thus, the integral evaluation of scientific and technical progress presumes the determination of its share in the increase of such indicators as the national income, the productivity of national labor, the profit, the profitability, the net output and so forth, which characterize the end results of activity at different levels of production.

By analyzing the indicated attributes of scientific and technical progress, it is possible, so it seems, to give a general appraisal of its present state in the sectors of the national economy. The more constructive nature of the above-cited definition of scientific and technical progress, in our opinion, consists in this.

Along with the correct interpretation of the essence of scientific and technical progress, the determination of the entire system of motive forces inherent in it is a most important condition of the construction of an effective mechanism of its acceleration. Some authors, when studying this question, along with the concept of the motive forces of scientific and technical progress, distinguish the concept of its sources (labor, the division of labor, education, science), understanding by them the direct causes and factors of scientific and technical development. At the same time the mediate causes and factors of this development (production relations, needs, interests) are grouped with the motive forces.[17] Other authors, while adhering to this point of view of the motive forces, group with the sources of scientific and technical progress its internal contradictions;[18] still others, while sharing the opinion of the contradictions of scientific and technical progress as its sources, understand by its motive force labor and social production.[19] The debate on these issues, in our opinion, is of a not entirely definite and consistent nature from the point of view of its ultimate goals--the elaboration of a set of measures on the acceleration of scientific and technical progress. As is known, objective contradictions, the unity and struggle of opposites are the fundamental sources of all movement and development, "the main attention," V. I. Lenin emphasized, "is concentrated namely on the knowledge of the SOURCE [in italics] of the movement 'ITSELF' [in italics]."[20] Thus, dialectics does not divide the concepts of sources and motive forces, but uses a unified concept of the sources of movement, defining them as contradictions. On this basis it is possible to say that the first of the indicated points of view, by using only the most general concepts, in essence does not bring the solution of the problem of the sources of scientific and technical progress to an end, to the requirement to identify its objective contradictions.[21] Although the second and third points of view do advance this

requirement, they interpret the contradictions of scientific and technical progress not as an expression of the essential internal and external ties of its elements, but only as a form of its development, which is void of content. The very content of the motive forces (labor, production relations and so on) is understood as being devoid of contradictions. However, Marxist-Leninist methodology requires the study of any object to be taken as far as the identification of its objective, essential, object contradictions. This is urgent both for the study of the motive forces of scientific and technical progress and, consequently, for the construction of the effective mechanism of its acceleration. While being a specific system and having unity, these motive forces have at the same time a dissimilar nature, which is connected with the many-sidedness of scientific and technical progress itself.

Thus, the progress of modern productive forces is the contradictory process of the development of manpower and the means of labor, which is connected with the limited psychophysical and occupational skills potentials of man with respect to the increase of the efficiency of labor in the case of each given level of technology. The motive force of this contradiction consists in the fact that it brings about the need for the development of the corresponding sectors of science, the development of new equipment and the transfer to it of the labor functions of man, the improvement of the occupational skills structure of personnel, which increases production efficiency.[22]

When examining the development of science and technology in connection with the changes of the social aspects of production, for example, the meaningfulness and conditions of labor, it is possible to distinguish a group of social contradictions of scientific and technical progress. Thus, on the one hand, the progress of technology is accompanied by the transfer of uniform, monotonous and difficult labor functions from man to machine, which makes labor more meaningful and appealing. On the other, at specific stages of technical progress (for example, in case of incomplete automation) the labor process is simplified to the utmost, leaving to the worker purely technical functions and functions which at times are rather dangerous for his health, which decreases the degree of satisfaction with labor and leads to other negative social consequences. This contradiction acts as a direct social motive force of the changeover to the complete mechanization of production, which eliminates the tendency for the one-sided development of the worker and ensures the fundamental combination of mental and physical labor.

In examining the influence of new equipment and technology on the environment, it is possible to distinguish a group of ecological contradictions of scientific and technical progress, which act as a stimulus of the elaboration of the corresponding scientific problems and the development of such means of production which, while promoting the maximum utilization of natural resources, would not disturb the equilibrium between society and the biosphere.

As is evident, the indicated groups of contradictions act as objective motive factors of scientific and technical progress, while reflecting at the same time specific laws of the development of science and technology.

The economic contradictions of scientific and technical progress or the contradictions of production relations and the interests, which mediate the processes of research, the development and introduction of new equipment, play a decisive role in the system of these motive forces. Taking into account that at present the

introduction of the results of the development of science and technology is the weakest link in the "science--production" system, the study of the conflicts of the economic interests of enterprises, which arise in the process of their work on the assimilation of new equipment, is of particular urgency. On these conflicts the main ones consist, in our opinion, in the following.

New equipment as an object of the interests of socialist enterprises assumes a commodity form and therefore contains a certain contradiction between its use value and value. In the process of the assimilation and production of new equipment it appears first of all in the form of a conflict between the interest of the enterprise as a unit of direct social production in the creation of a product of a high technical and economic level and quality, on the one hand, and the increased expenditures on its assimilation, which influence the realization of the interests of the enterprise as a cost accounting unit of production, on the other. As present such methods of the control of scientific and technical progress as the direct inclusion in the plan of the enterprise of models of new products with a great national economic socioeconomic impact and the offsetting of the expenditures (losses) of assimilation from centralized sectorial funds for the financing of the development of science and technology are aimed at the resolution of this contradiction, which is objective by its nature. However, the effectiveness of these methods is still low. The low level of the economic substantiation of measures on the assimilation of new equipment and the lack of unity in the methods of the calculation of the economic impact are having the result that not the most efficient new equipment from a national economic point of view is frequently included in the plans of enterprises. The sectorial funds of financing offset on the average not more than 40-50 percent of the additional expenditures of enterprises on the introduction of scientific and technical achievements. Under these conditions the further improvement of the methods of determining the national economic socioeconomic impact of new equipment and their fundamental incorporation in the mechanism of the formulation of the plans of scientific research work and production at different levels of management are necessary. Along with this the creation of an effective mechanism for the compensation of the losses of the economic stimulation funds of enterprises during the period of their changeover to the mass output of new products and retooling remains urgent.

Another contradiction, which is connected with the substantial differences of the levels of the profitability of previously assimilated and new products, also arises in the economic interests of enterprises when introducing new equipment. The standard profitability, which is being used at present when determining the wholesale prices for new items, proves to be, as a rule, considerably less than the actual profitability of previously assimilated products. It is possible to resolve this contradiction, in our opinion, primarily by the gradual reduction of the prices for the previously assimilated equipment. This requires the gradual and persistent realization in the practice of pricing of a mechanism of graduated prices which are established with allowance made for the progressive dynamics of the decrease of expenditures and the period of obsolesence by sectors and groups of items.

The conflict between the interests of the producers and users of new equipment, which arises with regard to the appropriation by them of the economic impact, is one of the important economic contradictions of scientific and technical progress. The resolution of this contradiction is accomplished by the distribution of the impact between the producer and user by means of the mechanism of pricing. However,

at present the producing enterprises are still receiving a negligible portion of the impact in the form of a markup on the price for new equipment. The lack of a direct connection in the methods of determining the markups on prices and the bonuses for new equipment is also a drawback. As a result the amount of the bonuses for the assimilation of new equipment frequently is frequently at variance with the amount of the incentive markups and, as a rule, makes up a negligible portion of them. In this connection it would be advisable to increase the stimulating role of the markups of prices and to change over to direct deductions from the incentive markup (the additional profit) for the fund for the payment of bonuses in accordance with a uniform standard.

And finally, it is necessary to note the conflict which arises in the economic interests of enterprises as a result of the differences in the conditions of the formation and the amount of the incentive funds, which are formed in accordance with the results of current production activity (first of all this is the material incentive fund) and for the development and introduction of new equipment (the special fund for the payment of bonuses to workers for new equipment). Since the development and introduction of new equipment frequently are backed to a more significant extent than basic production by stimulation funds, this conflict is resolved by enterprises in many instances not in favor of scientific and technical progress. It seems that the most effective resolution of this conflict consists in the direct subordination of the cost accounting incentive funds of enterprises to the tasks of the acceleration of scientific and technical progress.

The entire set of examined contradictions is resolved under socialism in the process of the planned improvement of the mechanism of the control of scientific and technical progress. This mechanism acts as a component of socialist management, which determines to the greatest extent the development of modern production. Therefore, in our opinion, it would be incorrect to regard the control of scientific and technical progress as a part or subsystem of production management.

Scientific and technical progress is turning into the main means of accomplishing the socioeconomic tasks of society, as a result of which it is more correct to regard its control on the basis of the consideration of its objective laws and contradictions not as a subsystem, but as the basis, the central link of the overall system of the management of socialist production. Precisely such an understanding of the role of the control of scientific and technical progress conforms to the greatest extent to the present economic situation and the tasks posed by the 26th CPSU Congress on "the acceleration of the changeover of the economy to the path of intensive development, the increase of the efficiency of social production."[23]

The accomplishment of this task at present is being complicated by the still considerable autonomy in the planning and stimulation of scientific and technical progress and current economic operations. This autonomy formed historically and was due to the peculiarities of the development of the national economy in our country.[24] At the initial stage of the building of socialism and during the period of industrialization there was no separate system of the control of scientific and technical progress, since the entire economic mechanism, which at the same time also encompassed the accomplishment of current national economic tasks, was oriented toward it. The need noted by V. I. Lenin "to link the plan of electrification with the current practical plans..."[25] and to envisage the issuing of bonuses to specialists, first of all "for the especially successful and quick fulfillment of

the most important of the organizing and technical assigments..."[26] found reflection, in particular, in this. The assumption of V. I. Lenin that socialism is inconceivable without equipment, which has been built according to the latest word in science,[27] was the basis for the management of the national economic during those years.

Subsequently, with the increase of the scale of production and the number of enterprises, organizations and construction projects, the complication of the production ties between them and the increase of production and personal needs, the reorientation of the economic mechanism and the increase in it of the functions of the management of so-called basic or current production gradually occurred. The acceleration of scientific and technical progress is formed into a special function of production management, for the realization of which special economic means were required. And back in the early 1950's, as G. Kh. Popov correctly notes, there arose a problem which exists to this day--the economy was divided into two parts: there is basic production and there is the new equipment which must be introduced in it.[28]

The needs of the intensification of production changed cardinally the demands on the system of economic managment. The need to transform the economic mechanism of the country into the mechanism of the control of scientific and technical progress became primary. This, in turn, requires the quickest possible integration of the general economic methods of management and a separate, special system of the control of the work on the development and introduction of new equipment. The point is that all the individual types of activity of enterprises do not exist by themselves, outside their connection with the general cost accounting activity of enterprises, which is aimed at the production of high quality products with the least expenditures of living and embodied labor. "...The individual," V. I. Lenin wrote, "does not exist other than in the connection which leads to the general."[29] In turn, the general exists not by itself, but only as what contains "all the wealth of the special and the individual."[30] The system of the management of the development of production should also conform to this necessary, natural connection of the general and the individual, the uniform and the diverse, which characterizes the logic of the functioning of systems of a different nature. It should encompass all the diverse forms of the activity of enterprises in their unity and should reflect the results of the work of production collectives by uniform indicators, among which those, which under given specific conditions promote to the greatest extent the intensification of production on the basis of scientific and technical progress, should be decisive. It is obvious that only in this case will the economic mechanism stimulate the increase of production efficiency on the basis of new equipment.

The special system of the control of scientific and technical progress should have as the sphere of its effect the scientific and technical activity of a basic, theoretical nature, the development and introduction of new equipment which improves working conditions and the environment, as well as measures, in accordance with which it is not possible to determine the economic impact, that is, that entire area of scientific and technical progress, which cannot be directly encompassed by the cost accounting mechanism of enterprises and associations.

Thus, science and the practice of management are faced with the fundamentally new problem of creating a unified system of the economic management of the development of production on the basis of scientific and technical progress. The objective contradictions of scientific and technical progress should find the most complete

resolution within this system, which will be a mighty stimulus of its acceleration and the increase on this basis of the efficiency of the economy.

FOOTNOTES

1. In the author's opinion, the most typical definitions of scientific and technical progress are cited in the article.

2. See D. I. Pravdin, "Political Economic Problems of the Control of Scientific and Technical Progress," VOPROSY EKONOMIKI, No 11, 1975, p 44; "Nauchno-tekhnicheskiy progress i effektivnost' proizvodstva" [Scientific and Technical Progress and Production Efficiency], Moscow, 1979, p 5.

3. See V. I. Pavlyuchenko, "Ekonomicheskiye problemy upravleniya nauchno-tekhnicheskim progressom" [Economic Problems of the Control of Scientific and Technical Progress], Moscow, 1973, p 25; "Upravleniye nauchno-tekhnicheskim progressom" [The Control of Scientific and Technical Progress], Moscow, 1978, p 15.

4. See G. A. Tsaritsyna, "Fondy ekonomicheskogo stimulirovaniya nauchno-tekhnicheskogo progressa" [The Economic Stimulation Funds of Scientific and Technical Progress], Moscow, 1973, p 26.

   Anticipating a little, let us say that precisely the idea of scientific and technical progress as a special sphere of activity of enterprises and organizations is the basis for the prevalent point of view of the need for the existence of a special system of the control of new equipment along with the general cost accounting mechanism of management.

5. L. M. Gatovskiy, "The Socioeconomic Nature of Scientific and Technical Progress Under Socialism," "Ekonomika razvitogo sotsialisticheskogo obshchestva" [The Economy of Mature Socialist Society], Moscow, 1977, p 90.

6. See G. S. Gudozhnik, "Nauchno-tekhnicheskiy progress: sushchnost', osnovnyye tendentsii" [Scientific and Technical Progress: The Essence, the Basic Trends], Moscow, 1970, pp 9, 11.

7. V. N. Cherkovets, "Methodological Aspects of the Determination of the Essence of the Scientific and Technical Revolution," "Sistema proizvodstvennykh otnosheniy kapitalizma v usloviyakh nauchno-tekhnicheskoy revolyutsii" [The System of the Production Relations of Capitalism Under the Conditions of the Scientific and Technical Revolution], edited by N. A. Tsagolov, Moscow, 1979, p 21.

8. O. I. Volkov, "Scientific and Technical Progress," "Ekonomicheskaya entsiklopediya. Politicheskaya ekonomiya" [An Economic Encyclopedia. Political Economy], Vol 3, p 42.

9. L. S. Mymrikova, "Scientific and Technical Progress: The Essence and the Mechanism of Acceleration," IZVESTIYA AKADEMII NAUK SSSR. SERIYA EKONOMICHESKAYA, No 3, 1977, p 28.

10. See A. I. Bogdanov, "Kompleksnoye planirovaniye i organizatsiya nauchno-tekhnicheskogo progressa" [The Comprehensive Planning and Organization of Scientific and Technical Progress], Moscow, 1978, p 23. Here it is important to note that the basic feature of modern bourgeois and petty bourgeois conceptions of scientific and technical progress "consists in the fact that given all the variant readings, their creators in like manner proceed from the metaphysical, pragmatic identification of the basic content of technology and socioeconomic relations" (Yu. Ya. Ol'sevich, "Bourgeois Interpretations of Scientific and Technical Progress," VOPROSY EKONOMIKI, No 2, 1980, p 117).

11. V. I. Lenin, "Poln. sobr. soch." [Complete Works], Vol 18, p 149.

12. See K. Marx and F. Engels, "Soch." [Works], Vol 23, pp 48, 404.

13. Ibid., p 351.

14. Ibid., p 397.

15. Ibid., p 404.

16. L. S. Blyakhman, "The Problems of Evaluating the Level of Scientific and Technical Progress at Enterprises of the USSR," "Izmereniye nauchno-tekhnicheskogo progressa predpriyatiy i ob"yedineniy" [The Measurement of the Scientific and Technical Progress of Enterprises and Associations], Leningrad, 1980, p 16.

17. "Soyedineniye dostizheniy nauchno-tekhnicheskoy revolyutsii s preimushchestvami sotsializma" [The Combination of the Achievements of the Scientific and Technical Revolution With the Advantages of Socialism], Moscow, 1977, pp 27-29.

18. "Istochniki i dvizhushchiye sily nauchno-tekhnicheskogo progressa" [The Sources and Motive Forces of Scientific and Technical Progress], Leningrad, 1978, p 11.

19. Ibid., pp 26, 27.

20. V. I. Lenin, "Poln. sobr. soch.," Vol 29, p 317.

21. Moreover, this point of view confirms the illegitimacy of the separation of the concepts of the sources and motive forces of scientific and technical progress. Indeed, how, for example, can labor act as a source of scientific and technical progress and in general be carried out without personal and production needs? And how can needs by themselves move scientific and technical progress without labor? Abstractions of this sort are impracticable. It is possible to settle correctly the question of the immediate sources of scientific and technical progress, in our opinion, by the identification of its internal contradictions as a category of the development of productive forces and its external contradictions with socioeconomic relations. Both determine the specific mechanism of the acceleration of scientific and technical progress.

22. In our opinion, V. I. Lenin had precisely this aspect of technical progress in mind when he wrote: "the progress of technology also finds expression in the fact that human labor is receding more and more into the background before the labor of machines" (V. I. Lenin, "Poln. sobr. soch.," Vol 1, p 78).

23. "Materialy XXVI s"yezda KPSS" [Materials of the 26th CPSU Congress], Moscow, 1981, p 143.

24. In the CEMA member countries the approach to the economic problems of the acceleration of scientific and technical progress is different. In some countries there are subsystems of the management of the development and introduction of new equipment, in others there are no such subsystems. In Hungary, for example, the stimulation of scientific and technical progress is backed by the entire system of the management of the economy without the use of any special methods.

25. V. I. Lenin, "Poln. sobr. soch.," Vol 42, p 344.

26. V. I. Lenin, "Poln. sobr. soch.," Vol 36, p 180.

27. Ibid., p 300.

28. "Problemy sovershenstvovaniya upravleniya nauchno-teknhicheskim progressom" [Problems of the Improvement of the Control of Scientific and Technical Progress], Moscow, 1975, p 9.

29. V. I. Lenin, "Poln. sobr. soch.," Vol 29, p 318.

30. Ibid., p 90.

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FINANCING CEMA SCIENTIFIC AND TECHNICAL RESEARCH

Moscow FINANSY SSSR in Russian No 5, May 83 pp 62-65

[Article by V. A. Gnutov, senior expert of the Main Currency and Economics Administration of the USSR Ministry of Finance: "The Financing of the Scientific and Technical Research Carried Out by the CEMA Member Countries"]

[Text] The contemporary stage of the economic development of most of the CEMA member countries is characterized by an intensification of social production on the basis of a thorough acceleration of the rates of scientific and technological progress, an improvement of the management of the economy, and a deepening of integration processes. In its turn, scientific and technological progress is impossible without an expansion of the material and technical base of science and technology, the introduction of the latest achievements of scientific thought, and a further deepening of cooperation between the socialist countries in this field.

One-third of the world's scientific and technical potential is concentrated in the CEMA countries. Around 3,000 scientific and technical organizations participate in multilateral cooperation here. In 1981 alone around 1,200 topics were developed through joint efforts and approximately 2,000 projects were completed. Every year 200-300 new or improved designs are created for machines, instruments, and equipment, 100-150 production processes are developed and improved, and 100-200 new types of materials and preparations are developed. In all, during the last 10 years more than 16,000 theoretical and applied development projects have been completed.*

The socialist countries are concentrating increasing attention on the priority directions of scientific and technological progress. The economic planning, currency and financing, and contract mechanism of cooperation is being perfected. Research is being performed in the form of coordination, cooperation, and joint work on selected problems.

The goal of the coordination is the elimination of parallelism and dupli-

*G. I. Marchuk, "USSR Participation in the Scientific and Technical Cooperation of the CEMA Member Countries in the Light of the Decisions of the 26th CPSU Congress"; Ye. Shopa and V. Prokudin, "An Improvement of the Scientific and Technical Cooperation of the CEMA Member Countries," EKONOMICHESKOYE SOTRUDNICHESTVO STRAN-CHLENOV SEV, No 3, 1981.

cation in research, an economy of material, labor, and financial resources and of time, and the creation of the preconditions for the reciprocal use on agreed-upon terms of the scientific and technical results which are obtained in each of the countries. Research work in the form of coordination is performed by national organizations independently in accordance with topics which have been agreed upon with all of the participant countries. In addition, there is an exchange of information about the directions, course, and results of work, reciprocal assistance in its performance and a subsequent exchange of its results, and relationships are established between organizations, institutions, and enterprises which are related in profile. One of the national organizations is endowed with the functions of a head one, but it does not enjoy any advantages or privileges with respect to the other organizations working with it.

When scientific and technical research is performed by means of coordination each side fully finances the part of the work which it has adopted. The shortcomings of this form of cooperation are connected with the absence of contract commitments, and the impossibility of redistributing the expenditures for the performance of expensive research among the sides. As a rule, the sphere of application of this form is limited to theoretical research which is not connected with large material expenditures.

All of this makes it necessary to carry out cooperation in other forms also, particularly, by means of cooperation.

Great importance is attributed to the further development of cooperation in the decisions of the 26th Party Congress, and in the recommendations of the recent sessions of the Council for Economic Mutual Assistance. In the Accountability Report of the CPSU Central Committee to the 26th Party Congress it was noted that "the CPSU and the other fraternal parties are adopting the course aimed at turning the forthcoming two 5-year plans into a period of intensive production and scientific and technical cooperation among the socialist countries."* It was emphasized that the question is being put on the agenda of a further development of direct relationships between the ministries, associations, and enterprises participating in cooperation.

Cooperation in performing scientific and technical research is a deeper process than the coordination of the international division of labor. It combines in itself a maximum coordination of the assignments which are being carried out by national organizations, and also of the stages and schedules for the performance of scientific and technical work in keeping with agreed-upon programs with the contract form of mutual commitments. In addition, cooperation relationships may be formed both on an

*"Materials of the 26th CPSU Congress," Moscow, Politizdat, 1981, p 7.

inter-state level and on the level of ministries, departments, and economic organizations.

Contracts are concluded for the purpose of regulating the rights and obligations of the sides and, above all, determining their mutual commitments to carry out research and development work, of regulating financing procedure, the guaranteed schedules and quality of the performance of assignments, the conditions under which work is performed, the legal protection of inventions and other objects of industrial property, licensing work, and others.

The financing of work which is performed by means of cooperation may be done separately or jointly. With separate financing each side covers its own expenditures for the part of the work taken up by it. In this case the contractual participation of the sides will correspond to the amount of work which is performed and must be specified as a whole in percentage relationships. With joint financing the sides agree on a total estimate of expenditures, and also on the amounts of work to be performed by them and on the expenditure estimates for them which are a component part of the contract. The estimates are drawn up in transferable rubles or in another agreed-upon currency and can be changed only with the agreement of the sides. They may provide for expenditures in freely convertible currencies. All of the expenditures connected with the performance of the work by means of cooperation are included in the estimates. They may also include agreed-upon amounts of expenditures for scientific and technical work which has been performed by the sides before the signing of the contract.

The expenditures for the wages of the scientific and technical personnel and the workers who are used for the performance of work on the basis of cooperation are determined in keeping with the amount of work in man-months or man-days (hours) stipulated by the agreement (contract) and their wage rates in transferable rubles. It is pointed out in the recommendations of the 65th meeting of the Ispolkom of the CEMA that these rates may be established by agreement of the sides on the basis of the rates which are employed by the interested sides when their specialists are given travel assignments to provide technical assistance and other services, or on another agreed-upon level.

The cost in transferable rubles of the materials and equipment necessary for the performance of the scientific research, planning and designing, and experimental work is calculated in accordance with the contract prices for analogous goods which are employed in the trade between the interested CEMA countries, while for goods for which there are no such prices, it is calculated in accordance with prices which are determined on the basis of the principle and methodology for setting foreign trade prices which are in effect within the CEMA, or in another agreed-upon manner. In the event that it is impossible to establish foreign trade prices for the materials and equipment which are being used, an agreed-upon cost in transferable rubles may be included in the estimate.

The evaluation in transferable rubles of the cost of the construction necessary for the performance of the work is carried out, as a rule, in accordance with the recommendations adopted at the 61st meeting of the CEMA Executive Committee. The estimated cost of construction expressed in a national currency is broken down into basically two groups: material and labor expenditures. The expenditures envisaged by the estimate for the materials, equipment, transportation equipment, depreciation of fixed capital, and other material outlays are recalculated into transferable rubles by means of comparing the estimated prices and those actually in existence between the CEMA for the basic commodity-representatives which are being used in the construction of the given object. Commodity-representatives have to comprise no less than 50 percent of the expenditures envisaged by the estimates for materials and equipment. A recalculation of all of the remaining material expenditures is performed on the basis of the average mean coefficient which has been obtained in this way.

In recalculating labor outlays the expenditures for wages in national currencies are increased by the amount of the social consumption and accumulations funds whose maximum level is determined in accordance with the surplus product norm, and the total which has been obtained in this way is recalculated into transferable rubles in keeping with the rate of exchange in effect and the coefficient for non-trade payments.

Expenditures for the temporary use (rental) of buildings, structures, equipment, and so forth are included in the estimate at agreed-upon depreciation rates or rental fees. The estimate also includes expenditures for electric energy and fuel in keeping with agreed-upon norms, overhead expenditures calculated in an agreed-upon amount of the wage fund, and others. When specialists from one side are given travel assignments to the organizations of another on the initiative of assigning organization the wages of the assigned specialists are included in the estimate of the dispatching side, while the overhead expenditures connected with the work of the specialists are included in the estimate of the receiving side.

The total expenditures which have been received in this way are distributed among the sides in accordance with their interests in the results of the work, the criterion for which may be served, for example, by the extent of the use of the research results within a country. In individual cases this distribution may be carried out in equal shares, or in another manner.

The income which is obtained from the realization of the research results in third countries, and other possible income is distributed among the sides in proportion to their shared participation in the expenditures.

The next form of cooperation is the joint performance of scientific and technical research. Joint performance is understood as work in research conducted in temporary international scientific research collectives, joint laboratories (departments), international budgetary or cost accounting scientific research and planning and designing organizations, and international scientific production associations.

In recent years, in order to perform specific work within the framework of priority problems increasingly wide use is being made of such a form of the unification of the efforts of the socialist countries as the creation of temporary international collectives of scientists and specialists on the basis of leading scientific, planning and designing, and production organizations. This is fostered by the relatively simple procedure for organizing them (on the basis, as a rule, of an international contract of an interdepartmental character), their relatively economical nature, and the possibility of making use of the scientific and technical potential and material base of the organizations at which they have been created. The most optimal financing method has been chosen for this form of the organization of scientific and technical research--the assignment to the cooperating sides of specific types of expenditures without the drawing up of overall estimates and the performance of complex reciprocal computations. Thus, the expenditures connected with the renting of housing, the use of equipment, computers, and apparatus, the maintenance of junior technical and auxiliary personnel, travel assignments by the collective's associates within the host country, and other current expenditures are made at the cost of the organization at which the temporary collectives have been created. They are paid for, as a rule, in the currency of the host country. The expenditures connected with the travel assignments, maintenance, and social insurance of associates who are sent to work in a temporary collective, and of the members of their families, are covered by the dispatching side in the currencies of the collective's host country and of the dispatching side.

Frequently it is necessary for a temporary collective to purchase expensive scientific and technical documentation, materials, special apparatus, instruments, equipment, and experimental models, to construct special objects, and so forth. These expenditures are covered by the sides jointly in transferable rubles. The expenditures connected with travel assignments for associates to participant countries or third countries may also be covered in transferable rubles. A special estimate is drawn up in order to determine the cost of these expenditures. The basis that is adopted here is an agreed-upon list of physical assets and the contract prices for them in transferable rubles. The estimate which has been drawn up in this way is subject to approval by the temporary collective's legislative body. In accordance with the shared participation which has been fixed for them, the sides cover the established part of their expenditures. Their payment may be made directly as a share contribution to the purchase of equipment, tools, materials, and so forth, or by the transfering of sums in transferable rubles to the account of the organization at which the collective has been created.

The concrete research results which are obtained are used gratis by the countries whose organizations are participants in the temporary collective. At the same time, they may also become the property of the remaining socialist countries to which they are given for a fee or on other terms, and may also be sold to capitalist or developing countries. The income which is obtained from this kind of commercial oepration is distribution, as

a rule, in proportion to the shared participation of the sides in the financing of the organization and the work of the collective.

Everything that has been said above regarding temporary collectives applies in full measure also to the joint laboratories (departments) which are created by the socialist countries.

A specific stage in the organizational unification of the efforts of the socialist countries is the creation of international scientific and technical organizations which may be budgetary, cost accounting, and of a mixed type, and also of scientific production associations. Most of the scientific and technical organizations presently in operation are budgetary ones. Their financing is carried out on the basis of the budgets (estimates) of these organizations by two methods. With the first the budget is made up in three currencies: the national currency of the host country (for the payment of administrative, managerial, and other current expenditures), transferable rubles (for the purchasing in the CEMA countries of equipment, tools, computers, motor vehicles, instruments, materials, and so forth), and, when necessary, in a freely convertible currency. With the second method the expenditures in the national currency are recalculated into transferable rubles and, along with material expenditures, are covered by the countries in this currency alone.

Recently there has been a clear tendency toward a differentiated approach to the organization and realization of cooperation on individual problems of science and technology in relation to the expected scientific and technical results and the work schedules. In this connection, it is planned to divide all of the topics of scientific and technical cooperation which have been adopted during the course of the coordination of scientific and technical development plans for the years 1981-1985 into three groups. The first is to include problems and topics the work on which will be completed during the current 5-year plan by the creation, introduction, and organization of the production of progressive machinery systems, equipment, and materials, by the mastery of new production processes, and so forth. The second group is to embrace problems for which the basic scientific research and planning and designing work and also the industrial testing is supposed to be completed during the current 5-year plan, with the introduction of the results ensured in the following one. Scientific and technical cooperation for these two groups of problems is supposed to be achieved above all on the basis of agreements, and also of contracts. In the third group it is planned to include problems of a basic and research character which are being solved basically by the scientific institutions of the sides, and also topics connected with the development of normative technical documentation and standards and with a reciprocal exchange and study of experience and scientific and technical achievements.

The classification of scientific and technical problems in one or another group, and also the gradual transference of scientific and technical cooperation onto a contractual basis largely determine the choice of the form for the performance of research. Cooperation and joint development work

are realized in the first two groups, and coordination in the third. At the same time, this does not mean that coordination cannot be used as an auxiliary form in the development of machinery, equipment, materials, and so forth, and cooperation and the joint performance of research are not used in solving problems of a basic and research character. It is a question of the choice of an optimal variant of the combination fo these forms.

Practical work testifies to a good theoretical work-up in the documents of CEMA agencies of the financial regulations of cooperation and to their successful realization. At the same time, there are, in our view, a number of questions which are subject to further clarification. They concern the attainment of a maximum equivalence in recalculating expenditures from certain currencies into others, an evaluation of the labor of scientific workers, agreement on the level of estimated expenditures, and others. A further improvement of the financial mechanism which has been examined is also necessary in connection with the implementation of a differentiated approach to the organization and realization of cooperation, and its shift to network planning which embraces the entire complex of measures in the "science-production-sales" cycle. With the scientific and technological revolution in progress, the increased role of economic levers, and the greater "science intensiveness" of scientific and technical results, demands are increasing upon the currency and financial mechanism itself upon whose uninterrupted functioning the effectiveness of cooperation in many respects depends.

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RELIABILITY OF SCIENTIFIC RESEARCH ORGANIZATIONS REPORTING INDICATORS

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[Article by A. G. Mil'chenko, economist: "On Checking the Reliability of the Reporting Indicators of Scientific Research Organizations"]

[Text] In the system of general state control a substantial place is assigned to the departmental control and auditing apparatus. The verification materials of a number of ministries and departments show that in most cases too little attention is devoted to checking the reliability of the reporting indicators which are included in the reports on scientific research and experimental designing work in the audits of the financial and economic work of scientific research organizations. As a rule, the checkers limit themselves to an enumeration of the figures which are taken from the reporting documents, without a critical analysis on the basis of checking the data of the primary account. Nor is this question illuminated in the necessary manner in the departmental instructional regulations on the performance of audits of the financial and economic work of scientific research organizations.

Before beginning to check the reporting data on scientific research and experimental designing work in scientific research institutes and designing bureaus the checker has to acquaint himself with the methodology for planning scientific research and experimental designing work which has been adopted in the organization. First of all, it is necessary to clarify how the planned estimated cost of each of the topics which are in the approved thematic plan for the planning period is delivered to the subdivisions (divisions, departments, laboratories, sectors, and so forth). Next, it is necessary to find out on the basis of which documents the list of the concrete projects in their plans for each topic is made up, and how it is tied in with the amount of work in its estimated cost. The checker has to convince himself that the subdivision's plans are made up on the basis of approved documents, and that the estimated cost of the work and the plans are approved before the beginning of the planning period.

A study of these questions will help the verifier to better orient himself in checking reporting data, since the system of reporting should be organized according to the principle of feedback; that is, the report goes along the same chain as the plan, but in a reverse direction. A violation of

this principle frequently testifies to the poor quality of the system of reporting and can promote extortion of reporting data on plan fulfillment. As a rule, the thematic plan of an organization consists of the amount of its own work and of work performed by outside enterprises (the other contracting party). The total of these two indicators represents one of the basic reporting indicators for an organization--the total amount of work in its estimated cost. This kind of structure is also characteristic for the work plan for the reporting period for each of the topics of the thematic plan. In this connection, recommendations on checking the data of indicators are cited separately.

Before beginning the analysis of these questions it is necessary to check the validity of the estimated cost of the topics which are included in the thematic plan of the reporting period. There has to be a comparison of the amount of the estimated cost of a topic which is included in the organization's thematic plan with the amount of its estimated cost in the plans of the subdivisions. The amounts have to be equal. If the amount of work included in the subdivisions' plans show an excess over the amount of work on the topic in the thematic plan this bears witness to the creation of an unwarranted reserve for the fulfillment of a plan either on the basis of decreasing the actual capacity of an organization regarding its own work, or on the basis of a deliberate understatement of the plan for the other party's work.

Such facts testify to violations by the leadership of an organization of the 12 July 1979 Decree of the CPSU Central Committee and Council of Ministers, "On Improving Planning and Strengthening the Influence of the Economic Mechanism on Increasing the Efficiency of Production and the Quality of Work." A similar conclusion can be drawn from the existence of work in an organization's report which is absent in the plan. But first it is necessary to convince oneself that above-plan work has been included in the report not to cover a fulfillment failure for the basic projects of the thematic plan. In any case, the checker has to establish and note in the audit document the financing source for the extra-planned work.

For example, in the thematic plan of an organization for the first quarter of 1982 800,000 rubles of its own work has been planned, and 220,000 rubles worth of work by the other contracting party. In comparing the number of topics in the plan and the report it was established that the thematic plan which had been approved by a superior organization for the first quarter of 1982 contains 38 topics, while 40 topics have been included in the report for the same period. There were no estimate calculations or contracts for the performance of these two projects in the organization. In a correction of the plan conducted 45 days before the end of the quarter these topics were not included in it. Nor were there orders or rulings from a superior organization regarding the performance of this work. Its total estimated cost in the plan of the first quarter of 1982 came to 80,000 rubles.

The auditor also established that for two other topics the planning department had included an estimated work cost of 300,000 and 450,000 rubles in the plans of the organization's subdivisions. But in the approved thematic plan 270,00 and 400,000 rubles, respectively, had been planned for these topics; that is, the thematic plan turned out to be understated by 80,000 rubles. Work by other parties was not provided for. As a result of what has been said above, the verifier had to note in the audit document that the administration had presented a thematic plan to its superior organization which had concealed reserves--160,000 rubles, or 20 percent of the plan for its own work. These resources had been assigned for the performance of above-plan work and the creation of a reserve for overfulfilling the plan. The document should note which source has been used to finance the extra-planned work.

An Organization's Own Work. In checking the validity of reports on the fulfillment of an organization's own work it is necessary first of all to direct attention to the topics for which there is shown during the planning period either a plan overfulfillment, or the conclusion of stages or of a topic as a whole. In checking on the validity of the overfulfillment of a plan for a topic the subdivision which has overfulfilled it should be established. Then it should be learned what exactly has been done in this subdivision on the topic beyond the approved plan during the reporting period, was this work in the calendar plan, how was its estimated cost determined, and what documents confirm its actual fulfillment during the reporting period (the minutes of tests, the delivery of finished technical documentation to a related organization or to the technical archive, and so forth). In difficult cases the auditor has to enlist a specialist who will be able to evaluate the fulness and correctness of the work included in the report as having been fulfilled in advance ("Regulation on Departmental Control of the Financial Economic Work of Associations, Enterprises, Organizations, and Institutions").

For example, in an organization's report for the fourth quarter of 1981 a plan fulfillment of 1.6 million rubles is shown with a plan of 1 million rubles, including for one topic the fulfillment of estimated costs for its own work of 106,000 rubles, with a plan of 100,000 rubles. The overfulfillment for the topic is shown in Department No. 10. At his demand the verifier was presented with the department's plan for the fourth quarter of 1981 which contained this topic with 18 work positions, which corresponded to the department's report on this topic with regard to the quantity of performed work. However, the fulfillment in the estimated cost for this work is shown as 6,000 rubles more on the basis of Position No. 15, "Laboratory Modelling, and the Testing and the Technical Assignment to the Designing Department." The time for the completion of the work on this position is the first quarter of 1982, and the cost is 6,000 rubles. The department's leadership included this position in the fulfillment of the fourth quarter plan as having been entirely fulfilled ahead of schedule. The verifier demanded that he be presented with the minutes of the tests of the model and with the technical assignment which had been given to the designing department. From these documents he saw that

the modelling had been finished on 15 April 1982 (the minutes of the laboratory tests), and that the technical assignment had been received by the designing bureau on 20 January 1982. On the basis of the established facts the conclusion was drawn that the 6,000 rubles had been included in the report of Department No. 10 and in the organization's report on this topic without grounds.

In checking on the validity and the inclusion in the report of work for which the completion of stages is shown it should be kept in mind that the "Instruction on the Procedure for Composing and Presenting a Report on the Fulfillment of Scientific Research, Experimental, Planning, Designing, and Technological Work and the Assignments of Scientific and Technological Programs" No. 217/29 which was approved by the USSR Central Statistical Administration on 10 June 1981 a definition is given of the completed stages and work projects as a whole which are included in the report (p. 6). In this connection, the verifier has to convince himself in the first place that all of the documents which substantiate the completion of a stage or of a work project as a whole are in existence and have been properly drawn up; that is, they contain the dates of the acceptance of the work, and the signatures of the deliverers and receivers. The contract and the calendar plan which is attached to it has to be used to establish the date of the completion of the delivered stage (project as a whole) and the form of the completion of a work (presentation of a technical report, annotations, mock-up, experimental model, and so forth).

It is recommended that the verification of the substantiation of the inclusion of finished stages in the report be begun with an examination in the accounting office of all of the documents on the fulfillment of the work and the presentation of it to the clients. Attention has to be directed to the existence of the documents themselves for all of the work delivered to the client and to the correctness of their composition (date, signature, stage number, its cost, and so forth). If there are documents according to which work has been accepted by the client before or after the reporting period, and its volumes have been included in the reporting period, the verifier has the right to notate the invalidity of the inclusion in the report of the amounts specified in the document. These documents have to be made up only after an executor has fulfilled all of the contract conditions regarding the stage which has been included in the document.

The following verification stage consists in discovering the actual state of the work on completed topics (stages) during the reporting period. As a rule, the technical report (annotation) composed in the established manner is the document which confirms the completion of work (topic, stage). It is essential to verify when this report has been examined at the Scientific and Technical Council (of a section) of an organization and approved by its leadership, and then sent to the client (number and date of the accompanying letter) and accepted by him. If the contract stipulates the delivery to the client of a model (mock-up) of a product, there should be an examination in the organization of the documents on the transfer of

the finished product from production to a scientific subdivision, the minutes on its tests, commodity transportation invoices, and other documents which confirm the actual shipment of the product to the client. At the same time, it is necessary to examine the product shipment permission in the security office in order to persuade oneself of the actual date of its shipment to the client.

With any other form of the completion of a topic (stage) a check has to be made on the basis of the primary documents of the precise compliance with the conditions and dates provided for by the contract. The practice of such checks shows that the work acceptance documents which serve for settlements for stages (topics) between organizations may not reflect the actual state of the work on a topic and are composed either prematurely, after the completion of the reporting period, or without any date at all. For this reason, it is essential to check them with the help of primary documents. For example, stipulation was made for the delivery of a report on a rough plan involving the presentation to the client of an operating mock-up of Stage No. 1 of a topic in the first quarter of 1981. The organization composed a document on its delivery which was signed by the client on 25 March 1981. On the basis of this document the planning department included a 250,000 ruble estimated cost for this stage in the report. The terms of the contract provided for its acceptance at the site of the executor with a summoned client's representative.

A check of the reports of an assembly sector of an experimental production has established that an operational mock-up was completed on 6 April 1981 and delivered according to the delivery invoice to a scientific subdivision's laboratory on the same day. According to the minutes of the laboratory tests, the adjustment of the unit was completed on 10 April, and the tests on 15 April 1981. According to the date in the minutes the examination of the report took place on the same day at the organization's Scientific and Technical Council. The report was approved by the director of the organization on 20 April, and accepted and signed by the client's commission on 28 April. On the basis of these facts the verifier drew the conclusion that the schedule for the first stage which had been stipulated by the contract had been violated, the acceptance document had been made up after the fact, and that 250,000 rubles had been included in the report for the first quarter of 1981 without grounds, since the work had actually been completed and written up in the second quarter.

Work by Other Contracting Parties. In checking on the validity of reports on the fulfillment of work volumes by other contracting parties it is necessary to bear in mind that in certain ministries and departments such work is not isolated from the total amount of topics either in the thematic plans of an organization, or in the reports. As a result of this, it is necessary to determine the amount of work by other contracting parties for which the organization has reported during the reporting period. The information lines 070 and 080 (payment for work performed on the basis of contracts with the organizations of outside ministries and one's own ministry) should be taken from Form 5-N (quarterly) "Expenditures for

Production" which is attached to the accounting balance and totalled up. The total which is obtained will represent the volume of work by other contracting parties which has been accepted for the report during the given period. The accounting office has to decode this total by topics and work executors. With this kind of information it is possible to begin the verification of the validity of the estimated cost of the topic which has been included in the report for this period which is being checked.

The auditor has to obtain information from the planning department on the planned estimated cost amount and those included in the report of the organization's own and the other contracting parties' work on every topic. If the data on their amount which has been included in the report in Form 2-NT diverges from the data of Form 5-N, the checker has to demand explanations from the appropriate services and make a detailed analysis of the reason for the divergences. As a rule, they indicate the existence of invalid inclusions in the report on the other contracting parties' work. Then, an examination has to be made in the organization's accounting office of all of the acceptance documents for work which has been performed by other contracting parties, directing attention to the fulness of these documents and the correctness of their composition: the presence of acceptance dates, delivery and acceptance signatures, numbers and cost of stages, and so forth. If the acceptance or delivery of work has been written up in the documents either before or after the reporting period, the conclusion can be drawn that the amounts specified in the documents have been included in the report invalidly. The delivery documents for the organization's own work and the acceptance documents for the work of other contracting parties have to be made up only after an executor has fulfilled all of the conditions of a contract. For this reason, with a mandatory check the actual state of the work at the moment it has been accepted by the client is clarified.

In order to do this it is necessary to acquaint oneself with the calendar plan of the work which is an inseparable part of the contracts, to elucidate which documents (products) and on what dates have to be presented to the client, and to check the fact of their presentation according to the primary documents. The checking method is similar to the method in the analysis of the methods of checking an organization's own work. If the acceptance of the work of other contracting parties is connected with travel assignments, it is necessary to persuade oneself of the existence of advance reports and reports on the travel assignments of the persons who have signed the acceptance and technical documents. From these reports the auditor is able to establish the actual time that the commission worked, and from the reports on travel assignments--the state of affairs at the object.

Example. A contract on a topic has been concluded with an organization for the delivery and installation of equipment in the first quarter of 1981 at the client's object in another city. On the basis of the work aceptance document which has come into the planning department and the accounting office and has been signed by both sides in the first quarter,

the planning department included 450,000 rubles in the report, and the accounting office transferred it as for work completed on schedule.

It was clear from the advance report of the acceptance commission's chairman (director of the topic for which a contract has been concluded with another party) that the commission was at the delivery site from 20 through 28 March 1981, and that the work acceptance document which was received in the accounting office had been signed on 27 March 1981. However, from the travel assignment report which had been approved by the organization's deputy director for science it followed that the other contracting party had only begun the installation of the equipment, since it had been delivered to the object by the executor in an incomplete form.

The checker studied the subsequent travel assignments of the organization's workers to this object and their reports. It became clear from them that at the time of the audit (August) the installation of the equipment had not been completed. On the basis of this data and of the explanations of officials the checker made an entry in the audit document on the invalidity of the inclusion in the report for the first quarter of 1981 of 450,000 rubles.

The Writing Up of the Results of a Check. The results of a check of the reliability of reporting indicators have to be described in the auditing document, and every discovered fact has to be reflected strictly in accordance with the documents which have been investigated by the checker, the normative documents, and the instructions on this question. There must be no presuppositions in the auditing act. Everything which has been discovered has to be described in such a way that the following is clear from the text: which normative documents(instruction) has been violated, who signed the documents in which the violations have been discovered, and what is the essence of the violation; on the basis of which of the organization's documents have conclusions been drawn regarding violations and what kind of damage has been done.

Having completed the check of the reporting period, the verifier has to make a generalization about the extent of the distortion of state reporting for all of the discovered instances of false additions in the reporting. It is necessary to name the amount of the approved thematic plans for this period, the amount which has been included by the enterprise's leadership in the report, the total amount which has been invalidly included in it, and also the real amount of the fulfillment of the plan. In addition, the percentage of plan fulfillment which has been shown for this period, and the real plan fulfillment has to be indicated. If an overfulfillment of the plan has been shown in the reporting period, while as a result of a check it is learned that in reality it was not fulfilled, the checker must, in accordance with the bonus payment regulation in effect at the given enterprise, determine the group of workers which has been provided illegitimately with rewards and reflect in the document the amount of bonuses which have been paid to them. In realizing the materials of an audit on this question the checker has to remember the 19 May 1961 Decree

No. 440 of the CPSU Central Committee and USSR Council of Ministers, "On Measures to Prevent Instances of the Deception of the State and to Increase Control Over the Reliability of Reports on the Fulfillment of Plans and Commitments."

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IMPROVED PRODUCTION CONDITIONS FOR NEW EQUIPMENT URGED

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[Article by M. A. Lupachev, senior scientific associate of the Scientific Research Finance Institute, candidate of economic sciences: "Improved Production Conditions for New Equipment"]

[Text] In the system of measures on new equipment a special place belongs to its mastery and production. The decisive role here is played by machine building upon which the reequipping of all of the branches of the economy depends. "The alpha and omega of scientific and technological progress," as was noted at the 26th CPSU Congress, "is the development of science. But it is above all machine building which is able to throw the doors wide open for the new. It is the task of machine building to take the advanced ideas which are created by scientific and engineering thought and, without delay, to master them and embody them in highly efficient and reliable machines, instruments, and production lines."* At the same time, it has to be noted that the production of new machine building output is one of the most complex directions of technological progress.

During the 9th and 10th Five-Year Plans there was a substantial increase in the production of new machine building output. During the 8th Five-Year Plan the series production begun of 1,400 types of new equipment, during the 9th--2,600, and during the 10th--2,700. At the same time, obsolete types of equipment were removed rapidly.

Despite the large dimensions of the renewal of machine building output, the proportion of types of products being mastered in the total amount of production is still small. During the last decade it even decreased somewhat. As an annual average during the 9th Five-Year Plan the proportion of output in the first year of mastery reached 6.6 percent in machine building as a whole, and during the 10th it decreased to 6.2 percent.

The slowing down of the growth of expenditures for these purposes had a definite negative influence here. During the 9th and 10th Five-Year Plans expenditures for the mastery of new machine building output increased much

*"Materials of the 26th CPSU Congress," Moscow, Politizdat, 1981, p 44.

more slowly than expenditures for other directions of the creation of new equipment. This is a result of their relatively low effectiveness. Here is the data (Table 1).

Table 1

Additional Profits per Ruble of Expenditures for New Equipment in Machine Building as a Whole (In Comparable Form)

(Kopecks)

	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980
For all measures	48.1	47.2	40.3	50.1	40.1	31.4	32.2	29.5	32.4	32.7
For the mastery of new types of output	28.1	23.3	19.7	27.4	17.9	11.0	11.4	16.4	11.1	11.6

We see that the additional profits per ruble of expenditures decreased in both cases. But its rates of decrease per ruble of expenditures for the mastery of new types of output are substantially larger than for other measures for the creation of new equipment. It was this which to a certain extent was the restraining factor on an increase in expenditures for mastery.

In general, the mastery of new types of output has always been difficult for any enterprise. As a rule, the expenditures per ruble of commodity output of types of products newly being mastered exceeded the average branch ones and worsened the indicators of cost accounting work. This, in its turn, decreased the interest of machine building enterprises in renewing output. Let us cite the following data as a confirmation (Table 2).

Table 2

Change in Expenditures per Ruble of Machine Building Commodity Output

(Kopecks)

	1977	1978	1979	1980
Average branch expenditures per ruble of output:				
Total commodity	82.12	81.42	82.47	82.56
Being newly mastered	83.44	83.86	84.24	84.42

A very fast decrease in its higher production costs is an important stage in the mastery of new types of output. The amount of the total costs of the production of new equipment is formed from the expenditures for the development of the technical innovation (scientific research and experimental designing work), for the creation and testing of an experimental model, and for the mastery of series production. It is clear that expenditures will produce an effect in the event that at every stage an accurate fulfillment of the work is ensured.

Unfortunately, the materials of checks performed by financial agencies of scientific research, planning and designing, and technological organizations and enterprises show that there are a number of shoftcomings here which are holding back the mastery of technical innovations.

Quite frequently numerous changes are made in the thematic plans for the creation, mastery, and introduction of new types of output which, of course, prolongs the introduction of scientific and technical development work into production; as a result, certain projects lose their relevance and the expenditures for them prove to be wasted. Of 16 surveyed enterprises and organizations of the Ministry of Machine Tool Building and Tool Industry in 1979 at 12 (70 percent) the new equipment plans were changed repeatedly. Frequently these plans provide for overly long work performance schedules. For example, in 1979 the Special Designing Bureau for Machine Tool Building of the Leningrad Machine Tool and Tool Association imeni Ya. M. Sverdlov completed the planned 6-year development, production, and stand testing of experimental models of welded machine tool parts with an estimated cost of 100,000 rubles and an economic effectiveness of 200,000 rubles.

Sometimes scientific and technical development work is not introduced for a long time into production, which drags out the receipt by the economy of an economic effect from its introduction, and leads to the obsolescence of new machinery and equipment designs. In 1976-1978 the Ul'yanovsk Head Specialized Designing Bureau for Heavy and Milling Machine Tools developed technical plans for the machine tool models UF0784, UF0786, UF0787, and 653MF3-3 with a total estimated cost of 188,500 rubles which to this day have not been introduced into production. Yet, the economic effect from these development projects was planned in the amount of 2,083,500 rubles. Nor has there been any introduction of the development work of the All-Union Scientific Research and Planning and Designing Institute of Reductor Construction on 10 topics with an estimated cost of 286,500 rubles which were completed by the institute in 1975-1977. The economic effect from them is envisaged at 1,877,500 rubles. A similar situation exists in the Ukrainian Scientific Research Institute of Machine Tools and Tools. Here, the development of unified optic tables began as early as 1967. An experimental model was produced in 1974, and series production began five years later. Development work performed by this institute in 1979 on the creation at machine tool building plants of automated sectors consisting of machine tools with programmed controls with an estimated cost of 198,000 rubles and an expected effect of 400,000 rubles is planned for introduction into production only in 1983.

Considerable funds are expended on scientific research work which for various reasons is halted before its completion. Moreover, the expenditures which are written off from production for halted scientific and experimental designing work have been increasing from year to year. There are frequent instances of actual expenditures for the creation and introduction of new equipment exceeding its estimated cost, of the duplication of work, and of expenditures which exceed the future returns.

Thus, the funds which are being assigned for the creation of new types of machinery and equipment are not being used with sufficient effect. One of the chief reasons, in our view, is the lack of unity of action on the part of scientific research, planning and designing, and technological organizations and enterprises which produce new equipment. The disunity shows up as early as the planning of new equipment: different schedules are set up in the plans of the developers and of the producers. It is essential to improve the methods of planning which have the task of direction all work on the creation of new equipment toward final results. The most acceptable is probably the special-purpose program method. The program has to be calculated with regard to all of the factors which influence the process of the mastery of a technical innovation. It has to name the concrete executors of each section who bear full responsibility for performance. This kind of approach will make it possible to concentrate the efforts of specialists at definite work stages, and to more rapidly reduce costs in mastering the production of new equipment.

The concentration of material, labor, and financial resources is one of the basic directions for accelerating the renewal of output and decreasing the cost of models which are being mastered. Today this problem has still not been solved. Sometimes funds which are assigned for the production of new output are atomized. For this reason machine building enterprises frequently do not meet their planning assignments for the production of new machinery and equipment, which, of course, has an effect upon the development of other branches of the economy.

The successful realization of scientific and technical development work is possible only if its introduction is of a mass character. However, an increase in the production of new output involving higher expenditures worsens the cost accounting indicators of an enterprise's work which, in its turn, becomes an obstacle to increased production. Effective measures are necessary for a very rapid decrease in the cost of products being newly mastered. But with the atomization of resources it is difficult to achieve this. For the process of the creation of new equipment models, from development to realization, has to be fully provided with all types of resources. In planning amounts of expenditures for these purposes funds have to be distributed in amounts which foster the most rapid mastery of new types of output and a decrease in its production costs.

An improvement of the financial and economic mechanism and a fuller utilization of financial levers and stimuli plays a serious role in the mastery of the production of new output.

One of the most important stimuli is compensation for increased mastery expenditures. There are many proposals today on improving the compensation mechanism which have the task of creating favorable conditions for enterprises mastering new types of machine building output. In recent years wide use has been made of the unified scientific and technical development fund (USTDF) for financing scientific research, experimental designing, and technological work, and for compensating expenditures for the development and mastery of new types of output. It was created for the first time in the Ministry of Electrical Engineering Industry in 1969 when the branch shifted to a new system of planning and economic stimulation for new equipment work.

At the present time, in accordance with the Instructions on the Procedure for Planning, Financing, and Keeping Account of Expenditures Made on the USTDF which was approved by the State Committee for Science and Engineering, Gosplan, the Ministry of Finance, and the USSR Central Statistical Administration on 22 October 1980, the USTDF is formed from two sources: the planned profits from the production and economic work of the ministry, and part of the additional profits from the realization of new highly effective output and output with the State Token of Quality. This procedure has increased the interest of enterprises in an extensive production of high quality products and in the renewal of their assortment.

The USTDF performs a dual role. Part of its monies finance scientific research work, and another part goes to compensate expenditures for the mastery and improved quality of output. It is very important to distribute the monies for these parts correctly. The USTDF has to cover the increased expenditures for the production of new output during the first year of its series production. However, in practice this is not always achieved: the amount of monies which are allocated for the mastery of the production of technical innovations does not permit the compensation of the producer enterprise for increased expenditures. Many enterprises which plan the mastery of the production of new equipment receive from a superior organization amounts from the USTDF which are several times smaller than their actual need, while certain of them receive nothing at all from this fund, although they participate in the creation of new equipment. As a result, the expenditures for the mastery of the production of new output are written off onto cost. All of this reduces the stimulating influence of the USTDF.

From the point of view of the economy, expenditures for mastery begin with scientific research and with the development of the bases of new technology and new types of output. Expenditures for science, one of the chief elements of the mastery expenditures, are compensated from the budget and from enterprises', associations', and ministries' own capital, and from the monies obtained by scientific organizations from contracts with clients. These expenditures sharply exceed the amount of funds for the introduction of new equipment (Table 3).

Table 3

Expenditures for Scientific Development and the Introduction of New Equipment

(Billions of Rubles)

	9th Five-Year Plan	10th Five-Year Plan
Expenditures for science from all financing sources (annual average)	15.4	19.4
Expenditures for the introduction of new equipment (annual average)	6.2	8.7
Including for the mastery of new types of output	0.73	1.02

Thus, the average annual expenditures for science are more than double those for the introduction of new equipment and 19 times greater than the expenditures for the mastery of new types of output. A disproportion arises between the rapid growth of scientific development work and its slow mastery in production.

A large stock of highly effective scientific and designing development work has been created. In order to realize it as rapidly as possible it is necessary to increase the amounts of funds which are assigned for its industrial mastery. In this connection, it would appear useful to carry out a certain redistribution of the USTDF funds in favor of that part from which enterprise expenditures for mastering the production of new equipment are compensated.

The incomplete financing of the enterprises which produce it also holds up the mastery of new equipment. The USTDF is concentrated at head enterprises which master the production of new products in the new equipment plan. However, this production based on cooperation is participated in by dozens, and sometimes hundreds of suppliers and producers of component products, units, and materials. In many cases there are no coordination plans which unite the efforts of all of the enterprises. As a rule, USTDF funds are not allocated to supplier enterprises of component products which are subordinate to various ministries. Without financial sources for the compensation of their additional costs, these enterprises either do not at all organize the production of finished output, or prolong its mastery in production excessively. Financing from the USTDF must be overall. Toward this end, coordination plans on the mastery of their production which unite the efforts of all of the participant enterprises have to be worked out for all of the most important types of new equipment. Let the overall plan for the financing of the mastery of new equipment become one of the sections of this plan.

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BETTER MATERIAL INCENTIVES FOR NEW EQUIPMENT DISCUSSED

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[Article by Yu. I. Berliner, chief of the Department of Scientific Research and Production Planning of the "Soyuztyazhmashtekhnologiya" All-Union Production Association: "On an Improvement of Material Incentives for New Equipment"]

[Text] An important distinctive characteristic of the cost accounting system for the creation, mastery, and introduction of new equipment on the basis of schedule orders (contracts), and also of the Regulation on the Formation and Planning of the Material Incentives Fund which was approved on 10 April 1980 by the State Committee for Science and Technology, Gosplan, the State Committee for Labor and Social Problems, the USSR Ministry of Finance, and the AUCCTU and which is in operation today in scientific research, designing, and technological organizations is its thrust toward strengthening the dependence of the material incentives for workers upon the economic effect which is obtained as a result of the introduction of new equipment.

The material incentives fund (MIF) for the creation, mastery, and introduction of new equipment is formed at enterprises and organizations on the basis of several sources. Basically, these are allotments from profits as a result of an actual decrease in output costs and of the profits obtained thanks to incentive wholesale price mark-ups. Monies which are included in the estimated cost of operations are stipulated as additional sources.

However, as an analysis of several machine building ministries shows, only up to 20 percent of the MIF is paid out in these organizations for work to decrease the cost of output; that is, on the basis of the economic effect; the remaining 80 percent is paid out on the basis of the estimated cost of the work.

The result of the work of scientific organizations is signified not only by the fulfillment of the amount of planned work and of the plan by products lists, but, above all, by the economic indicators which are achieved in the production and use of the output which has been produced. The estimated cost of work in institutes is not directly connected with the effectiveness of equipment which has been created, and, for this reason, a high percentage

of the payments from the MIF on the basis of the estimated cost of work says nothing about such highly effective work of the institutes. It is necessary to improve this work and, correspondingly, to decrease MIF payments on the basis of the estimated cost of operations.

In recent years the Ministry of Heavy Machine Building has done a great deal to increase the effectiveness of the work of its scientific research and production planning institutes and, in this connection, to regulate the questions of bonuses for their workers.

Especial attention has been devoted to the quality of the institutes' thematic plans, and to their interconnection with the new equipment plans of the All-Union Production Associations, with the capital investment plans, and with an increase in production capacities. According to the established procedure, a topic is included in the plan only after an examination and approval of the technical requirements for its fulfillment, and after a technical and economic substantiation. This has made it possible to reject inauspicious topics which do not help to create effective new equipment. There is now much less work in the institutes which does not correspond to their specializations: in 1977--11.8 percent, and in 1981--1.2 percent. The possibility appeared of concentrating resources on work which raises the technical and organizational level of the technological conversions and directions which are assigned to the institutes, including work to reduce manual and heavy labor, economize resources, and develop specialization and cooperation in production.

In order to eliminate parallelism and the duplication of topics, measures have been taken to improve the specialization of technological institutes, and this has made it possible to sharply decrease the number of thematic directions assigned to each of them (from 336 to 47 directions and from 117 to 65 projects), and to ensure the unity of technical policy with respect to the basic types of production. The amount of work aimed at the creation of a scientific and technological reserve has increased (16.7 percent in 1981 compared to 5.2 percent in 1976). This has helped to make it possible to begin the development of a number of auspicious production processes--vacuum-film molding, plasma-machining, a fundamentally new way of producing axles, and others which in the coming years will be able to be introduced into the branches with a substantial economic effectiveness.

The time involved in fulfilling and introducing development work has been decreased from six to three years.

A number of measures have been carried out to improve the system of planning scientific research and production planning work. In particular, planning has been instituted for the work of institutes on the technical and economic indicators of operations at the plants of a branch: economic efficiency, a decrease in costs and labor intensiveness, the releasing of personnel, and an economy of metal. This makes it possible to concretely evaluate the effectiveness of the work of the institutes, and to more precisely define in the plans goals and topics and the fields and schedules for the

use of research results. After the adoption of the measures the planned economic effect from the introduction of development work in the branch in 1982, compared to 1978, increased by 33.8 percent.

All of this could not but have an effect upon the size of the material incentives funds (MIF). Whereas during the last 5-year plan the amount of actually performed work in its estimated cost increased by 123.4 percent, and the amount of introduced projects by 128 percent, while the economic effect confirmed by plants from introductions increased by 152 percent, the amount of bonuses for institute workers increased by 144 percent. Moreover, bonuses for institute directors increased by 1 percent, by 31.3 percent for the chiefs of the basic departments, and by 50.6 percent for the immediate performers of the work.

Nevertheless, an analysis bears witness to the existence of reserves for increasing the effectiveness of the work of the institutes. An effective lever here is the efficient and purposeful use of the MIF, and of all of the advantages of the cost accounting system for the planning, financing, and economic stimulation of work on new equipment.

The following table shows the structure and amounts of the MIF of the scientific research, planning and designing, and technological planning organizations of the Ministry of Heavy Machine Building, the Ministry of Electrical Engineering Industry, and the Ministry of Power Machine Building. (Table is on the following page.)

We see that most of the MIF is comprised of monies which are included in the estimated cost of work. In order to reduce it and, correspondingly, the growth of the MIF on the basis of the fulfillment and introduction of projects which decrease output costs and bring additional profits in the form of price mark-ups it is necessary to carefully review an institute's thematic plan: what is the thrust of the work, who is its client, how does it influence the creation of new equipment. We are interested first of all in the branch scientific research and production planning institutes where all of the difficulties of introducing cost accounting are most graphic.

1. The MIF based on monies which are included in the estimated cost of work in relation to the economic effect which is obtained by the client of other ministries and departments.

An analysis of the work which is performed for other ministries and departments bears witness to a lack of system in its direction, and to its performance out of connection with the specialization of institutes and with the solution of one or another pressing branch economic problem. In most cases this consisted of the development of documentation without any guarantee from clients regarding the prospects for introduction. As a result, the amount of this kind of work was sharply decreased: on the average from 18 to 3 percent, and for individual institutes--from 30 to 5-6 percent. This made it possible to concentrate the efforts of collectives on the

(In Percent)

Formation Sources	Ministries		
	Ministry of Heavy Machine Building	Ministry of Electrical Engineering Industry*	Ministry of Power Machine Building*
Additional profits resulting from cost reductions	19.2	8.9	13.1
Additional profits in the form of price mark-ups	21.0	25.3	10.4
Advance included in the estimated cost of work	12.5	8.8	6.6
Monies included in the estimated cost of work:			
Depending upon the economic effect for the client of other ministries and departments	11.6	---	39.4
Results not expressed in the form of economic effect	7.7	---	25.7
Work performed for a ministry's enterprises	3.0	---	---
Centralized bonus fund	25.0	22.6	---
Other sources	---	34.4	4.8

*See: V. Shalimov, "The Formation of Material Incentives Monies for New Equipment," PLANOVOYE KHOZYAYSTVO, No. 6, 1981, pp 71-79.

introduction of advanced technology by the enterprises of their own ministry, and on work to mechanize and automate production, reduce manual and heavy physical labor, and economize metal; that is, on work which promotes a decrease in output costs and the formation of the MIF on the basis of this decrease. For the enterprises of other ministries and departments work began to be performed (with a mandatory introduction guarantee) for which the ministry was the head one, work on the transmission of documentation and on providing technical aid with new technological processes, and also individual projects in the institute's specialization and connected with technical assistance to the enterprises of a region.

2. The MIF on the basis of monies included in the estimated cost of work whose results are not expressed in the form of an economic effect.

This work includes chiefly technical and economic projects: the development and realization in associations and at enterprises on the basis of an analysis of their work and of the technical level of production of special-purpose overall programs, and annual, 5-year, and long-term plans for the development of technology, the mechanization and automation of processes, and the economizing of labor and material resources; an analysis of the technical level of production and the development of measures to raise it; an analysis of the use of production capacities and the development of proposals on improving it, and reviews of the state and development of the basic production processes; an analysis of the state of and the working out of proposals for the development of parts and units specialization; an analysis of the use of and the development of measures which promote a decrease in the expenditure norms for materials and fuel and energy resources, and so forth. This far from full list covers today 30 percent of the work of an institute, although according to the existing regulation the amount of work which does not have an economic effect should not exceed 20 percent.

Work of a technical and economic character is performed by institutes jointly with enterprises and all-union production associations and is very important for the future development of production. How is its volume to be decreased? There are as yet no fundamental proposals on this issue, but it is already possible today to map out the ways for improving it which in the future will make it possible to decrease its amount without, there is no question of this, worsening the quality of work.

First, a careful study should be made of the work load of institutes with projects or topics that are not characteristic of them and whose content is closer to the specific work of other institutes. This can probably include the analysis of production capacities and the development of proposals on their use, work on the development of parts and units specialization, and others. It would be expedient to give this work to planning institutes which, in accordance with the regulation, have the task of planning the development of production and which are capable of performing such work more successfully. Its centralization and planning institutes would make it possible to decrease costs and time schedules, and to find better solutions for the difficult problems of inter-branch specialization.

Secondly, there should be a review of the periodicity with which individual projects are carried out. For example, there is no practical necessity for the composition of annual handbooks on repair and tool productions with an abundance of information whose collection and processing takes much time away from both the enterprise and the institute. A decision has been adopted in the Ministry of Heavy Machine Building to make up such handbooks only at the beginning and the end of the 5-year plan. Thirdly, although every year the products list, character, content, and methodology for the performance of technical and economic work are different, its volume is unchanged. The fact is that having at one time formed special subdivisions, the institutes allow them to continue with the same composition, without

adapting it to the performance of concrete projects and setting up a work volume for a given sum. Of course, such a practice is imperfect.

Fourthly, institutes have to be resolutely barred from work whose performance is the direct function of enterprises. Work of a technical and economic character is to a substantial extent connected with the collection of materials on the actual state of affairs and with the development of measures to improve production. Frequently enterprises transfer these duties to institutes. Without mentioning the great labor intensiveness of such work, the quality of its performance leaves something better to be desired, and sometimes the materials which are manufactured do not at all accomplish the task which has been set.

In recent years many projects have appeared in technological institutes which are directed at the creation of new equipment, at the intensification of production, a reduction of manual labor and the number of workers, an economy of metal, and so forth, and which do not have any economic effectiveness. They are connected with the creation and introduction of robotized sectors, automated production complexes, and automated and mechanized lines. However, it has already become an axion today that institutes have their greatest effectiveness from work not on the creation of technology, but on the improvement of existing technology.

Economic effect is usually characterized by an economy from a decrease in costs. With the mechanization and automation of production this effect is achieved thanks to a decrease in labor intensiveness and a corresponding economy of wages. Since the proportion of the latter does not exceed 20-25 percent of the cost of output, and the cost of mechanization equipment being introduced is frequently greater than of the equipment in use before this, the economic effect is small and, sometimes, lacking altogether, and the capital expenditures reimbursement period exceeds the normatives. In determining, for example, the effectiveness of the introduction of industrial robots according to the existing methods, we obtain a greater annual effect not in those cases where the level of the mechanization and automation of production processes is low, but, on the contrary, in those places where it is higher and, consequently, the cost of the base means of labor is higher.

In view of the negligible economic effectiveness of such work or its frequent absence altogether, bonus payments are also included in the estimated cost of work, and usually the MIF is computed and paid out on the basis of the wage fund of those people who are engaged in this work.

3. The MIF on the basis of monies which are included in the estimated cost of work which is performed for a ministry's enterprises and whose results do not influence a decrease in output costs.

It includes: work performed for reconstruction plans and for increasing the capacities of operating enterprises in order to increase production; the development of non-standardized equipment for new or reconstructed

shops; and development work which brings about a decreased need by enterprises for circulating capital (work which decreases the length of the production cycle, and so forth).

In order to take a decision to decrease the amount of such work in institutes, from the point of view of including the MIF monies in its estimated cost it should be broken down into two groups. The first includes: the development of production processes and of non-standardized equipment whose use produces an economic effect in the economy. This includes an improvement of the methods of the thermal working of parts and the technology of painting and galvanizing, an increase in the reliability of parts, units, and machines, and so forth. As a rule, the performance of such work requires research and tests under laboratory and production conditions, which is basically the function of the institutes. The inclusion of MIF monies in the estimated cost of such work is legitimate; attention only has to be called to the reliability and validity of the economic effect which is obtained and which is mandatorily agreed upon with the output consumer. The second group consists basically of the development of non-standardized equipment and rigging for newly commissioned capacities. As a rule, it is difficult for development workers to calculate the effect here, since this equipment has been put in the construction plan and the economic effect from the entire complex of work has already been calculated by the planning institute at the stage of the technical and economic substantiation of the construction of the object. Moreover, because of its complexity most equipment of this kind can and should be planned by the enterprises themselves.

Another part of equipment represents new developments which possess serious technical and economic advantages over the already known solutions and which directly foster a decrease in the cost of output. Such work is also the prerogative of institutes, and the MIF for it has to be formed on the basis not of the estimated cost of the work, but of sources connected with the economic effectiveness of production.

4. The centralized bonus fund (CBF).

The financing of work from the unified science and equipment development fund (USEDF) makes it possible to ensure the unity of the technical, planning, and financial direction of scientific and technical research, and to concentrate resources on the key problems of technological progress in a branch. For this reason especial demands are made upon the work which is financed from the USEDF and provided with incentives from the CBF. The lack in the past of a list of work subject to stimulation on the basis of the CBF frequently led to an inefficient use of this fund.

In the Ministry of Heavy Machine Building a strict definition was made of the list of work which is financed from the USEDF and provided with bonuses from the CBF. This includes, first of all, research work, and also work aimed at the creation of equipment which sharply decreases the labor intensiveness of production (chiefly under hard and harmful working conditions), the creation of new equipment for export or to replace imported

output, and of new equipment which is especially important for the development of the branch. In addition, bonuses are paid from the CBF for the following work for which incentives funds cannot be formed on the basis of other sources: the creation, mastery, and introduction of new equipment which has social, technical, and other types of effect in addition to an economic one; independent technical economic research; work on scientific and technical information and patent research; and the development of technical, economic, social, and other forecasts.

The monies of the CBF comprise, as is shown above, around one-fourth of the total amount of material incentives. However, an analysis convinces one that there are still large reserves for a more effective use of this source. Only 30 percent of the projects which are provided with bonuses from the CBF are aimed directly at the creation of new equipment, while the remaining 70 percent simply cannot be provided with incentives on the basis of other sources.

As a result of the tangible material advantages of the CBF compared to other incentives sources, development workers sometimes unjustifiably increase the cost of work from which, in the final analysis, the MIF is made up, which, in its turn, leads to an increase in the amount of analytic, statistical, and review work in the institute. This is also promoted by the insufficient precision of the regulation with regard to work provided with bonuses from the CBF, and work for which the economic effect cannot be calculated.

5. Consideration should be given to the use of the MIF in the form of an advance employed for work with a length of over two years. According to the regulation, if the guaranteed success is not achieved with introduction, the executor returns the appropriate part of the advance. Two problems arise here: the rapid mastery of the development work of the institutes, and the attainment of the planned technical and economic indicators.

The introduction of a cost accounting system for the performance of work in institutes on the basis of contracts with enterprises provided in the first place for the organization of continuous planning for it along the entire cycle of "research-production." Meanwhile, in practice this unbroken continuity is far from always complied with in the thematic card catalogues which are made up by the institute and the plant, just as the final stage is not always present--the introduction of the development project.

An institute is not an isolated organization which lives by and for itself. It is closely connected with the work of other organizations, above all, enterprises. The effectiveness of an institute's work, and the forms and amounts of the material incentives for its workers depend to a large extent upon the character of their inter-relationships. In our view, not all is well in these inter-relationships. In essence, there is no legislatively established responsibility on the part of enterprises for the realization

of institute development work. Enterprises gladly conclude so-called economic contracts with institutes for the development of technical documentation, frequently giving no special thought to the time involved in its realization. Contracts for the creation of new equipment are financed from the USEDF which is allocated by the ministry, and the enterprise itself has no expenditures for the ordered work. Contracts for work with institutes which are financed from output costs are a great rarity. As a result, documentation lies around for years and grows obsolete, and either requires reworking before introduction, or turns out to be a total loss. During the 10th Five-Year Plan in the Ministry of Heavy Machine Building around seven million rubles worth of development work by technological institutes was not realized; 65 percent because of delays in the construction of shops, 17 percent on account of an excessively long introduction, and 9 percent because of the late ordering of equipment and component products. And institutes, having obtained an advance for the "paper" part of their work, wait for years for the introduction of their creation and for their material rewards.

There needs to be a fundamental reorganization of the inter-relationships between the institute and the plant. It is necessary to change the standard regulation on the procedure for concluding economic contracts for scientific research, experimental designing, and technological work in accordance with the new conditions of planning, financing, and economic stimulation, having clearly defined the legal rights of the client and the executor. The client is obliged to be responsible for the introduction of the executor's work within the schedule determined by the contract, and to provide guarantees of allotments to the incentives fund of the executor of amounts determined by the economic effectiveness of the work as agreed upon and approved of by the size. It would be good, in particular, to provide, in the event of the introduction of work belatedly or incompletely through no fault of the executor, for the payment by the client of amounts of incentives based on his own funds formed from planned profits. If the guaranteed economic effect is not achieved through the fault of the client, the executor does not have to return the advance to him.

The interest and responsibility of enterprises (production associations) for the punctual and full introduction of contractual work has to be strengthened. Experience shows that amendments to the plans for new equipment and for the introduction of advanced technology have almost become the rule. On account of this the dates for the production and introduction of new equipment and production processes are repeatedly pushed forward, technical documentation becomes obsolete, and the development workers suffers losses through not obtaining the planned economic effect and the stimulation funds.

Analysis also shows that only around one-half of the introduced development projects reach their planned technical and economic indicators. The basic reasons are a smaller than planned production of products, the incomplete use of equipment, and the removal of some of the product list from production.

6. The question of obtaining an MIF on the basis of price mark-up as a result of a product being awarded the Token of Quality is a somewhat unique one for technological institutes. In practice, after the approval of the computation of the economic effectiveness of the new product, the MIF is divided by agreement between the work performers: the plant and the designing and technological institutes. Without touching upon the contribution of the first two, let use examine the participation of technological institutes in the work on awarding a product the Token of Quality. It consists in the preparation of production: the development of the production processes, tools, rigging, and non-standardized equipment. However, in most cases there is no innovation here which makes it possible to reduce the labor intensiveness of production in the cost of output. In essence, this is ordinary rigging which a plant itself is quite capable of making. In this case the institute performs the functions of a plant's engineering services.

Meanwhile, the amount of the MIF which is obtained by the institute does not reflect its real contribution to the work, and the degree of its performance of its functions as the head technological organization. In individual institutes the amount of the MIF based on allotments from price mark-ups reaches 30 percent of the fund's total amount, although with regard to labor intensiveness this work comprises up to 5 percent of the institute's total labor intensiveness. The established procedure orients institutes not toward the development and introduction of advanced technology, but toward the performance of ordinary technological operations for which it is easier to obtain the MIF.

It would seem that it would be more correct to evaluate the participation of technological institutes in work to prepare the production of products with the Token of Quality on the basis of economic effectiveness as a result of the development and introduction of advanced technology which ensures the achievement of the planned indicators for labor intensiveness and the cost of new products in comparison with the existing technology. The first work which has been performed by the ministry in this direction demonstrates the appropriateness of putting the question this way.

The cost accounting system of the organization of work to create, master, and introduce new equipment, and also the new system of economic stimulation have palpably fostered an acceleration of scientific and technological development work and the introduction into production of new equipment. However, there are substantial reserves in the use of the MIF for a further intensification of work. Their realization will serve as a powerful lever for accelerating scientific and technological progress.

2959
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ESTONIAN ACADEMICIAN DISCUSSES PREPARATION OF QUALIFIED SCIENTIFIC CADRES

Tallinn RAHVA HÄÄL in Estonian 2 Aug 83 p 2

[Article by Arno Köörna, Academician, Vice President, EsSSR Academy of Sciences: "Current Problems of Training Scientific Cadres"]

[Text] Transition from a predominantly extensive growth to an intensive one poses several new problems to science and requires adjustments of emphases in existing ones. More than ever before such factors as buttressing scientific work with unique apparatus, the most modern laboratory equipment and data processing, improvement in the internal structure of science by development of the construction and experimental sectors, and acceleration of implementation of scientific research have become important.

Stabilization and some decline in the number of personnel in science and its servicing branches means that the workload of every specialist engaged in science is increasing, since the number and volume of research tasks is not decreasing but increasing. In this situation scientific institutions must pay more attention to the qualification of scientific cadres, to its capacity and to the securing of the necessary material and technical means for research activities, as well as to the establishment of a climate conducive to creative activity within the scientific collective.

In a novel situation where the solving of the most complicated technical and socio-economic problems of a developed socialist society is unthinkable without science, new demands are made of scientific personnel. For example, in addition to high qualifications, the necessary mental capacity and preparedness and determination to achieve the goal in a scientific endeavor the scientist must also be trained to implement the achieved results. Not everyone is equally qualified to do this. Determination, talent and knowledge are required. For this reason it is important to form scientific "teams" that consist of mutually complementing specialists, including some go-getter colleagues with practical application interests.

Such a collective in praxis is the best contributor to practical application of research results. Experience has shown that without the contribution of scientists the research results will remain on the shelves. Practical applicators are too busy with current work to delve into scientific "tracts."

Just as important are the requirements regarding the methodological and ideological-political training of scientists.

The hatchery of the scientific cadres is in the universities, especially within the scholarly student societies functioning there. Many of the recognized scientists of our republic have taken the first steps on the field of science in the UTU [Student Scientific Society]. Now a scientific society for secondary school students has come into being, enabling young people to gather first impressions of science and scientific work.

It is known that a university does not train people specifically for research activities. Sociological research regarding the adjustment of young specialists in research institutions has shown that in several institutes the young are not introduced to the specifics of research in the most sensible manner in order to reduce the adjustment period. Apparently it is crucial that every scientific institution pay more attention to the newly arrived young people, and encourage them to acquire the necessary scientific methods and methodology more rapidly, and to assist them in this. The junior scientists and the scientific-technical personnel with a bend for independent research should be especially cared for. They should be led to appropriate research topics within the programs of the institute, and an advisor should be appointed. As the work progresses such young people could be recommended for post-graduate study, or the preparation of their dissertations at the work-place could be encouraged.

Usually candidates and doctors of science are considered in the training of qualified scientific personnel. An analysis of the qualifications of the scientific cadres in our republic's central scientific organization, the Academy of Sciences, shows that 61.5 percent of the scientists have doctoral or candidate degrees. Data shows that during the last 6-7 years the number of candidate and doctoral degrees has grown faster than the influx of scientists. This is indicative of a rise in the average qualifications of the scientific cadre. In comparison with the other fraternal republics the picture is quite nice. But when one considers the departure of high qualified scientists due to old age, one must be far from satisfied. For this reason it is most important that the training of candidates and especially doctors from the young gifted scientific cadre be considered in all scientific agencies. This should not be taken as a call to make the training of candidates and doctors an end in itself. The dissertations must be prepared within the basic directions of the institutes' research activities, within the framework of projects underway and in the course of research activities. The point is that those scholars who are preparing their dissertations should be given favorable opportunities for research trips, practical training, and that they should be excused from peripheral tasks so that the writing of the dissertation will not be hindered.

The traditional institution for training scientific candidates is the research fellowship. Within the Academy of Sciences the fellowship is available in 43 specialties and it provides for an influx of cadres with scientific degrees. The fellowship as a whole is functioning smoothly, but in several specialties the results leave much to be desired. Wherever the

work is directed by recognized scholars and a full-blooded creative atmosphere exists dissertations are prepared on time. But unfortunately this is not the case everywhere. In various institutes hardly half of the post-graduate students successfully conclude their tenure, i.e. by defending the dissertation or by presenting a dissertation for defense. For example, the majority of the fellows in the Institute of Physics defends its dissertation either during the fellowship or in the year following, while in the Institute of Experimental Biology only a quarter of the fellows have defended their dissertation over the last seven years. In that institute the fellowship has been reduced to one nonresident fellow.

Two reasons should be mentioned among the causes of low productivity among the fellows.

First, deficiencies in selecting candidates and secondly the weak advising of the fellows, poor organization and supervision of their work. In some institutes there is practically no competition in selecting candidates and the acceptance plan is met with great difficulties. For this reason some young people who just dropped in for a look are accepted into the program. There is no systematic plan in the colleges to select suitable candidates for the fellowship, something that should begin in the UTU. On the other hand, the base of the Physics Institute in the Tartu State University has achieved great success in securing young cadre for the institute. The Institute of Cybernetics is currently preparing a base in the Tallinn Polytechnic Institute, so that that department can start functioning as early as the next school year. Several institutes have close contacts with institutions of higher learning, with scholars lecturing, holding seminars, offering special courses, taking part in senior advising and examining commissions. Such cooperation with colleges should be organized and expanded by all institutes.

The institutes should expand opportunities for senior students and graduating thesis composers for pre-diploma work, as well as for performing independent research and thesis research within institutes.

Recently attempts have been made to assure that post-graduate fellowship candidates have passed all or some of the qualifying examination for a candidate degree. Thirty-six percent of the 1982 graduate fellows have done this. This provides for a more rational use of the fellowship tenure and this practice should be expanded. In addition to selecting candidates for the fellowship the quality of advising is the second important factor in the raising of the fellowship productivity. We have fine advisors who pay careful attention to their fellows and whose advisees are therefore successful. For example, A. Raukas, corresponding member of the EsSSR Academy of Sciences, was advisor to four of the five fellows in the Institute of Geology who successfully defended their dissertations between 1976 and 1982. R. Pullat, doctor of history, has been the advisor to eight successful fellows in the Institute of History. Academician K. Rebane and L. Rebane, doctor of mathematics and physics, are among the successful advisor in the Institute of Physics. In addition to the many fine advisors there are those who have many advisees but none of them completes the dissertation.

The organization and advising of the fellows in the institutes must improve. This means that instead of the formal evaluation of the candidates they must be given the necessary working facilities, provided with high-level advising, and be required to report periodically on their projects in sectors and laboratories, as well as given basic and thorough evaluations in the institute's council, to include a report by the advisor.

Considering the limited opportunities of the academy and the republic to train new scientific personnel we must make greater use of impact fellowships, i.e. send fellows to the major USSR research centers, to the best institutes where opportunities exist to work with experienced scientists under the guidance of highly qualified specialists, using the best research techniques and laboratories. Experience proves the high qualifications of personnel trained in the USSR central research institutions.

Currently 36 percent of resident fellows are studying in the impact fellowship program. There are still opportunities to increase this percentage.

The so-called elite among the scholars is represented by the doctors of sciences. The majority of them is directing the more important research projects, some of them have their own schools of thought, some direct scholarly institutions and their component agencies. The growth of doctorates from the young cadre is slow, for this reason the average age of the doctors is rising. Currently a third of the doctors working in the academy have passed age 60. For this reason more effort must be made in the research agencies to train people for the doctorate. This is all the more important since the distribution of the doctors among specialties is uneven. In some institutes the doctors can be counted on the fingers of one hand, even though it would be natural to assume that laboratories or sectors be headed by persons with doctorates.

In some promising specialties there are no doctors at all or very few of them. The training of doctors is of course no rapid campaign. The doctoral dissertation grows from a long-term fruitful independent research and represents either a new direction for research or the solution of a problem having economic, political or socio-cultural importance. The primary requirement is that those who are writing their dissertations should be allowed to concentrate completely on the conclusions of their research. They must be excused from extraneous tasks, be provided with assistants and research equipment, the publication or practical application of their work must be facilitated, etc., etc.

Not only every scientific agency but throughout the scientific community of the republic should compile a long-term program of research pursued by scientific agencies and the institutes for higher learning. This should be compiled by the council for coordinating natural and social sciences with the help of the entire scholarly community, so that work in this important sector can be pursued according to plan.

Within the academy more use should be made of the opportunities to dispatch potential doctoral candidates for up to one year to the major USSR scientific centers to conclude and formalize their research.

Only personnel that has had good specialized training and erudition, but also high political and moral characteristics, that has firmly acquired the Marxist-Leninist world view is capable of tackling the great and complicated tasks of modern science. In the political training of scientific personnel a great job is done in the methodological (philosophical) seminars that exist in all scientific institutions. The work of the seminars would become even more fruitful if the party organizations of the institutes would increasingly and more skillfully tie specialized questions to Marxist-Leninist theory.

Results and success of science in the solving of the long- and short-term problems of the society depend mainly on the scientific personnel, their opportunities and capabilities. A comprehensive effort to improve the working and living conditions of those who are in the forefront of scientific-technical progress and who are establishing there new postions must be of primary importance to the managers of science. We have much to do to improve the material and technical base of science, to secure working facilities for the scholars, to improve their living conditions, etc. The scholars' creative work does not recognize official working hours, personal comfort and well-being. It would be most unfair to abuse this total dedication to science. Good material conditions for creative work pay rich dividends in moral, social, as well as material aspects.

The cooperation of those who plan for the distribution and use of such resources is welcome.

The CPSU Central Committee's June plenum resolutions calllfor activization of scholarly research and for a decisive turn toward solving the key problems faced by the state. To such tasks the training and education of scientific personnel and the management of their work must be subordinated.

9240
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MECHANIZATION AND AUTOMATION USED TO REDUCE MANUAL LABOR

Moscow MASHINOSTROITEL' in Russian No 3, Mar 83 pp 1-2

[Article by V. M. Grigor'yev, secretary of the Central Committee of the Machine and Instrument Builders' Trade Union: "Growth Reserves in Labor Productivity"]

[Text] The 26th CPSU Congress has set specific tasks for further improving labor protection in production, creating the necessary conditions to increase labor productivity, and reducing manual, unskilled, and heavy physical labor. These tasks must be resolved by the comprehensive mechanization and automation of production processes, the creation of safe technology, and the installation of equipment with safeguards to protect people from dangerous and harmful production factors. The congress pointed out the necessity to substantially increase the production of machine and equipment systems, and automatic manipulators with programmed control which make it possible to do away with unskilled manual and montonous labor, especially under conditions which are arduous or harmful to human beings.

Bearing these tasks in mind, the machine and instrument building industries are conducting systematic work to reduce manual labor in central and auxiliary production, to mechanize and automate it, and to perfect equipment and technology. All this promotes not only increased labor productivity but also a qualitative change in its content, transforming it into labor which is inspiring, skilled, and brings people a sense of satisfaction.

Until recently these issues were not receiving the necessary attention on the part of economic organs or trade unions. But after the CPSU Central Committee and USSR Council of Ministers passed the decree "On the Further Development of Machine Building in 1978-1980," the industrial sectors developed comprehensive goal-oriented programs to reduce manual labor, introduced them to collectives of production associations, enterprises, and organizations, and are currently implementing them. As a result of carrying out these programs, the years of the 11th Five-Year Plan will see a reducation in the use of manual labor in machine and instrument building enterprises. Calculations show that USSR Gosplan targets for 1981-1985 to reduce the number of workers engaged in manual labor can be surpassed. Ministries have already found ways to overfulfill these targets by almost 17,000 persons.

But the experience of past years shows that the problem of reducing the use of manual labor can be successfully solved by daily, painstaking work of economic leaders, trade union committees, and primary organizations and governing bodies of scientific-technical associations and the All-Union Association of Inventors and Rationalizers. It is necessary to apply maximum efforts for full implementation within the established time periods of integrated plans to improve conditions, labor protection, and sanitary-health measures for 1981-1985. These plans call for improving workers' labor conditions and reducing the number engaged in manual labor, especially heavy physical labor, as well as freeing women from this sort of work entirely.

Goal-directed work to mechanize manual labor is being done at the Voronezh Forging-and-Pressing Equipment Plant imeni M. I. Kalinin.

The casting production facility there has given up the traditional cupolas, replacing them with electric furnaces. This made it possible to fully mechanize one of the labor-intensive operations--the knock-out of large castings from the molds. This was done by introducing a facility with a telescopic rolling cover and systems of balanced ventilation and wet cleaning of waste gases and dust. Its outfit also includes equipment for clearing away scorched earth, and conveyor transport equipped with exhaust ventilation. As a result, labor conditions in the shop have improved significantly. The economic effect of adopting the facility totals 13,000 rubles per year.

Since the introduction of the mechanized, continuously-operating facility for preparing the molded, self-hardening mixture, the production level has improved, as well as sanitary-hygienic labor conditions; the use of vibrating tools has become unnecessary, and dozens of molders have been freed from manual labor. At the same time, labor productivity has increased by a factor of 1.5-2, and the annual economic effect totals about 25,000 rubles.

Much is being done at this plant to mechanize auxiliary production. Every year, about 200 units of hoisting and transport mechanisms are introduced there, and non-transloaded container transport of parts and intermediate products is widely used. Currently about 3000 different containers are being used in technological production, and 12 mechanized warehouses are in operation. This has made it possible to release 90 men from manual labor. The mechanization level of loading-unloading, warehouse, and transport work is currently 86.2 percent.

This initiative of the working people of Zaporozhskaya Oblast has circulated at machine and instrument building enterprises; "Manual Labor--On the Shoulders of Machines."

Thus, an integrated, goal-oriented program for the 11th five-year period calls for the Petrodvortsovyy Watch Plant in Leningrad to mechanize the montonous manual labor of 580 watch assemblers and inspectors. At the present time, the labor of 220 persons has already been mechanized, and in just one year 150 assemblers have been released from manual jobs. The adoption of assembly robots has made it possible to convert from traditional conveyor-belt assembly to separate, all-mechanized lines equipped with robotized assembly complexes. The labor of assembly complex adjusters has become more meaningful and interesting, and less tedious. At the same time, labor

productivity in assembly increased by a factor of 5-8. For achievement of high results in the field of mechanization and automation of manual and heavy labor, the plant's collective was awarded the AUCCTU Certificate and Prize in 1982.

Work is being systematically conducted to reduce the use of manual labor in the following production associations: the Armavir Vesoizmeritel' Association and the L'vov Mikropribor Association imeni 60-letiye Sovetskoy Ukrainy; the following watch plants: the Orel Yantar' Plant imeni 60-letiye SSSR, Moscow plants Nos 1 and 2 imeni S. M. Kirov, and the Minsk Plant; and also in the Leningrad Electromechanical Plant and other enterprises.

The Trade Union Central Committee is using various forms of supervision over the work being done in this direction by trade union committees and economic leaders of associations and enterprises in the machine and instrument building industries. It is being discussed in meetings of the presidium and secretariat of the Trade Union Central Committee. In the examination of sector standards, technical conditions, and targets, particular attention is being focused on outfitting machinery, tools, and equipment with mechanization and automation devices (delivery of intermediate products and parts).

Thus, in accordance with the Trade Union Central Committee initiative, the Ministry of Machine Tool and Tool Building Industry developed and submitted for the Central Committee's approval standard recommendations to modernize casting and forge-and-pressing equipment which has been taken out of production but is still in operation. Recommendations to modernize metal-cutting equipment are at the negotiating stage.

In 1982 the Trade Union Central Committee implemented selective checking of the technological part of projects to construct new production facilities and re-outfit existing ones to reduce the proportion of manual tasks. During the appraisal, specific proposals were introduced to reduce manual labor and to include additional mechanization and automation measures in the designs. This work will be continued in 1983 as well.

Significant improvement was made in the organization of work to reduce manual labor after the AUCCTU worked out an integrated, goal-oriented program for trade unions to participate in the work to reduce manual labor in the industrial sectors of the national economy in 1982-1985, and for the period up to 1990.

Ministry directives have determined the subdivisions responsible for coordination work to mechanize and automate production processes. In the Ministry of Instrument Making, Automation Equipment, and Control Systems, these obligations rest on the Soyuztekhnopribor All-Union Production Association; in the Ministry of Machine Building for Light and Food Industry and Household Appliances--on the Soyuzorgetekhavtomatizatsiya All-Union Production Association; and in the Ministry of Machine Tool and Tool Building Industry--on the Orgstankinprom Scientific-Production Association. In accordance with the Trade Union Central Committee's proposal, these ministries have created commissions, headed by deputy ministers, to monitor the drafting and implementation of goal-oriented programs to reduce manual labor. These commissions also

include responsible workers of the Trade Union Central Committee. Similar commissions have been formed in each sub-sector. Each sector designates head institutes which are responsible for implementing a unified technical policy in these issues.

With the consent of the Trade Union Central Committee, ministries have drawn up lists of machines and equipment to be removed from production. Work with such machinery involves monotonous, dangerous labor, and also conditions which are burdensome and harmful to human health. They have drawn up lists of professions where manual labor is used, subject to immediate mechanization, and set the number of workers which each of these professions may employ in such labor.

It is important to note that the plan is to reduce manual labor by adopting advanced technology and automatic manipulators with programmed control (industrial robots).

Thus, in the 11th five-year period, the Ministry of Machine Tool and Tool Building Industry plans to organize large-series production of robots for various purposes, including the servicing of metal-cutting tools, forge-and-pressing equipment, and casting machines. The Ministry of Instrument Making, Automation Equipment, and Control Systems has developed an integrated, goal-oriented program to create and adopt robots, manipulators, and robotics complexes. A similar program is also being drawn up in the Ministry of Machine Building for Light and Food Industry and Household Appliances.

Even now, loading-unloading, warehouse, and transport operations account for a large part of manual jobs. The mechanization level of these jobs is growing from year to year, but not quickly enough.

The Ministry of Machine Building for Light and Food Industry and Household Appliances' approach to this problem deserves attention. In accordance with the ministry's instructions, the Crimean Project-Design Technological Institute has developed standard resolutions to increase the organizational-technical level of loading-unloading, transport, and warehouse jobs; these have been approved by the Soyuzorgtekhavtomatizatsiya All-Union Production Association and sent to all enterprises of the sector. They list 116 different mechanization devices, the technical characteristics and types of jobs where they can be used, and the approximate cost; they indicate the manufacturing plants or developing plants and the blueprint series. Fifteen plants of the sector are responsible for preparing these small-scale mechanization devices.

Despite efforts to reduce the use of manual labor, there are still shortcomings and unexploited opportunities. The USSR Gosplan targets to reduce manual labor are not always achieved, especially in the first years of the five-year period, which entails the necessity of making up the losses in subsequent years, and this is not easy to do. Therefore economic leaders and trade union committees of associations and enterprises must now assess their capabilities in resolving this problem and use them actively, which will make

it possible to improve labor conditions and the level of production, and increase labor productivity. In resolving the problem of mechanizing and automating manual tasks, the scientific-technical community must make its contribution as well--the primary organizations and governing bodies of scientific-technical associations and the All-Union Association of Inventors and Rationalizers. It is necessary to expand the practice of holding drives and contests, schools of advanced experience, and seminars. The central boards of the scientific-technical associations of machine building and instrument building industries must not stand on the sidelines in regard to such an important economic and social problem as reducing manual labor; ministries' scientific-technical councils, sectorial journals, and sectorial scientific-technical information institutes must also get involved.

Trade union committees of associations and enterprises must make wider use of principles of moral and material incentive to adopt new technology. In this effort, indicators of the implementation of measures to reduce manual labor must be included among the basic factors considered in calculating the results of socialist competition for enterprises, shops, and sections. Issues of reducing manual labor must be reflected in collectives' agreements and plans for economic and social development of labor collectives. An attitude of systematic planning, whole-hearted work, and specificness, plus initiative and a sense of lofty responsibility on the part of every worker and manager--all this will make it possible to achieve and surpass the targets for reducing the use of manual labor, which will, in turn, promote the successful fulfilling of the targets of the five-year plan by each enterprise, and by machine-building sectors as a whole.

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BOOK ON SCIENTIFIC-PRODUCTION COMPLEXES

Alma-Ata NARODNOYE KHOZYAYSTVO KAZAKHSTANA in Russian No 4, Apr 83 pp 77-80

[Review by Doctor of Economic Sciences Professor N. Mamyrov of "Nauchno-proizvodstvennyye kompleksy" [Scientific-Production Complexes] (based on materials of Kazakhstan). Authors' collective headed by Kazakh Academy of Sciences Corresponding Member U. B. Baymuratov. Alma-Ata, Nauka, 1982.]

[Text] At the stage of developed socialism, the most important factor for further social-economic growth is the intensive development of science and technology, and widespread adoption of their achievements into production. Resolution of these tasks is largely ensured by the existence of scientific-production complexes (SPC)--a progressive way to integrate science and production.

It is worth noting that the problems of SPCs have not as yet been sufficiently elucidated in the economic literature. The operating experience of SPCs in the national economy has not received ample generalization and theoretical interpretation; the conditions of forming complexes have not been sufficiently analyzed; there are no well-substantiated recommendations for choosing their form and determining their rational structure and dimensions; and questions of investments in SPCs and the economic mechanism have not been adequately formulated. In our republic, questions of SPCs have received practically no study. The book being reviewed represents an attempt to substantially fill in these gaps, and bridge the rift between theory and practice. And this makes it unquesionably timely and significant.

The book consists of two sections, nine chapters, which logically deal with both the theoretical and the practical aspects of the problem. Beginning the work with an examination of general problems of uniting science and production, the authors disclose the essential nature of this union as one of the laws governing modern economics, forming as a result of the scientific-technical revolution. The objective basis of this process, in their opinion, comes from the needs of production, on the one hand--its intensification in all directions--and from the necessity to make effective use of the accumulated scientific experience, on the other.

The most profound illustration of the drawing-together of science and production is the development of scientific-production complexes. The SPC, as the book proves, is not merely the sum of its component parts, but an integral system whose elements are interconnected on the basis of an overall goal. The SPC ensures unity for all stages of the research-production cycle, and consequently accelerates it by a factor of 1.5-2.

Practice has brought numerous types of SPCs to life. An analysis of the experience of SPCs existing in industry has made it possible to demonstrate their advantages, classify them according to various indicators, and formulate basic principles of their formation.

Several consequences of the creation of SPCs are also elucidated, in particular the influence of this process on the expansion of reproduction. With regard to this, the authors dwell on the corresponding changes in the reproduction of fixed capital and manpower.

Since SPCs are built on the principle of technological unity of all subdivisions, the investment aspects of their creation have great significance. The book examines methods of predicting and determining the effectiveness of SPCs, and also an investment model.

Also important is the examination of shortcomings in planning, administration, and incentives within the SPCs; the book makes recommendations for overcoming them. It particularly emphasizes the role of socialist competition in SPCs.

The authors recommend that the economic mechanism by which a SPC functions should as a rule be implemented in close coordination with measures to improve the level of planning and incentives in scientific-technical progress, and with the well-known decisions stipulated by the party and government to improve the economic production mechanism.

In examining the general conditions for creating SPCs in the republic, the authors show the development which has taken place in the relationship between science and production. Not only industrial but also academic science is investigated. The authors conclude that the SPC has not become sufficiently widespread in Kazakhstan. They outline a set of problems for which the republic should put together goal-oriented scientific-technical programs. Clearly it is worthwhile to include in these programs problems concerning the development of scientific-production complexes.

A special place is occupied by specific concerns of SPCs in leading sectors of Kazakh industry--ferrous and nonferrous metallurgy, phosphorus and coal industries, and machine building. A thorough analysis of the scientific potential of these sectors has shown that at the present time, SPCs are found only in nonferrous metallurgy and machine building (the latter has the most developed form of them--scientific-production associations); in the coal-mining industry a sufficiently great potential has come about. At the same time, the conditions necessary for forming new SPCs and developing existing ones are coming into being in all sectors. Taking into account the particular sectorial characteristics of developing and adopting new technology,

and also based on the presence of the scientific potential, the foundations are being laid for the creation of various types of SPCs.

It is also necessary to touch on certain of the book's shortcomings. For example, in analyzing the experience of existing SPCs, the authors focus primary attention on scientific-production associations as the most developed form of them, giving insufficient exposure to the nature of types such as institute complexes.

In elucidating the matter of SPCs' economic mechanism, it would have been best to indicate the particular characteristics of planning and incentives in various types of complexes.

In the chapters concerning SPCs in individual sectors, a more thorough examination was called for concerning the coordination of capacities of individual subdivisions making up the SPC.

But these omissions do not affect the overall value of this useful work. The authors have successfully dealt with their task and prepared a fundamental work which is of unquestionable scientific and practical interest.

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PRIZEWINNERS IN GEORGIAN PRODUCTION EFFICIENCY

Tbilisi ZARYA VOSTOKA in Russian 19 Nov 82 p 2

[Text] The Georgian SSR Council of Ministers and Georgian Council of Trade Unions have summed up the results of republic socialist competition for invention and production efficiency in the first half of 1982.

The adopted decision observes that in the first half of this year over 17,000 persons, who submitted for examination 15,700 proposals, participated in socialist competition for invention and production efficiency.

In the first 6 months of the current year there was an increase in the assertiveness and creative results of the innovators, inventors and efficiency experts in the accomplishment of the most important tasks with respect to an acceleration of the rate of scientific-technical progress, the creation and use of inventions and efficiency proposals aimed at an increase in labor productivity, economies in fuel-energy and other material resources and the mechanization of manual labor.

Some 120 inventions and 12,300 efficiency proposals, including 22 inventions and 2,265 efficiency proposals aimed at economies in intermediate products, raw material and fuel-energy resources, 15 inventions and 806 efficiency proposals aimed at the mechanization of manual labor and 3 inventions and 225 efficiency proposals aimed at an increase in labor productivity, were introduced in the republic's national economy.

A savings of the order of R36.1 million, including R6.4 million from inventions, was obtained from the use of inventions and efficiency proposals.

Some 5,760 tons of metal, 1,058 tons of reinforcing-bar steel, 4,350 tons of fuel, 22 million kilowatt-hours of electric power, 8,355 cubic meters of concrete, 1,560 tons of cement and 1,290 cubic meters of lumber were saved as a result of the introduction of inventions and efficiency proposals.

The number of provisionally released workers here amounted to over 1,500, and more than 300 were transferred to mechanized work.

There was a considerable increase in the number of authors submitting proposals, and the total savings obtained from the use of inventions and efficiency

proposals passed the level achieved in the first 6 months of 1981 by R7.8 million (27.7 percent).

At the same time as a result of inadequate organization and leadership of socialist competition for invention and production efficiency a deterioration was allowed to occur in the corresponding indicators at enterprises and in organizations of the GSSR ministries of communications, land reclamation and water resources and forestry, the "Gruzugol'" Production Association and also at the Tbilisi Industrial Machine Tool-Building Association, the Rustavi Crane-Building Plant and the Poti "Elektroapparat" Plant.

The GSSR Council of Ministers and Georgian Republic Council of Trade Unions observed that a whole number of ministries, departments, enterprises and organizations still underestimates the role of the creativity of inventors and efficiency experts as a most important reserve of the growth of labor productivity, economies in fuel-energy, intermediate product and raw material resources and the mechanization of manual labor and that the innovators' efforts are not being mobilized for the accomplishment of urgent technical tasks of production (the GSSR ministries of rural construction and land reclamation and water resources, the GSSR State Committee for Supply of Petroleum Products, the "Gruzugol'" and "Gruzvinmash" production associations, the "Mikrodvigatel'" Plant, the Zestafoni "Gruzkabel'" Plant and the "Gruzsel'mash" Plant).

The leaders of certain of the republic's enterprises and organizations are failing to observe the established procedure of the compilation and presentation to the GSSR Central Statistical Administration of statistical accounts on the inflow and use of inventions and efficiency proposals, as a result of which a considerable proportion of the technical innovations and their technical-economic indicators being used in production in practice are not being duly reflected in the overall results of invention and production efficiency work for the republic as a whole.

The GSSR Council of Ministers and Georgian Republic Council of Trade Unions adopted the proposal of the republic Commission for Leadership of Competition for Invention and Production Efficiency and the Summation of Results and for the achievement of the best results in the first half of 1982 acknowledged as the winner among ministries and departments the GSSR Ministry of Motor Transport, awarding it the diploma I class. The diploma II class was awarded to the GSSR Ministry of Housing and Municipal Service and the diploma III class to the GSSR State Committee for Supply of Production Equipment for Agriculture [Goskomsel'khoztekhnika] and the Tsekavshir' Board.

Among administrations, associations and trusts, the diploma II class was awarded to the GSSR Ministry of Motor Transport Tbilisi Truck Transport Production Association and the GSSR Ministry of Construction "Stroyindustriya" Trust and the diploma III class to the Consumer Service Administration of Tbilisi, the Tbilisi Gorispolkom Repair and Construction Trust and the GSSR Goskomsel'khoztekhnika Gori Production Association.

Among enterprises and organizations, the diploma III class was awarded to the GSSR Ministry of Motor Transport Kutaisi Experimental-Machine Plant of the

"Avtotranstekhnika" Production-Engineering Department and the "Gruzglavmontazhspetsstroy" Gardabani Plant of Installation Intermediate Products.

Among administrations, associations and trusts of union jurisdiction, the diploma II class was earned by the "Kavkazelektroset'stroy" Trust and "Elektrovozostroitel'" Production Association and the diploma III class by the Ministry of Civil Aviation Georgian Administration, the "Gruzgidroenergostroy" Trust and the Tbilisi Metro imeni 50-letiya Velikogo Oktyabrya Administration.

Among enterprises and organizations of union jurisdiction, the diploma II class was conferred on the Tbilisi Aviation Plant imeni Dimitrov and the Ministry of Civil Aviation Georgian Administration Tbilisi Airplane Enterprise and the diploma III class on the Zestafoni Ferroalloys Plant, the Kutaisi Auto Plant imeni G.K. Ordzhonikidze, the Tbilisi "Tsentrolit" Plant and the Batumi Oil Refinery imeni Stalin.

The GSSR Council of Ministers and Republic Council of Trade Unions instructed ministry, department, association, enterprise and organization leaders to outline in conjunction with the appropriate trade union committees and All-Union Inventor and Efficiency Expert Society councils concrete measures for the fuller and more purposeful use of inventions and efficiency proposals in the accomplishment of urgent tasks of technical progress, regarding this work as an important reserve of a rise in the level of mechanization and of the growth of labor productivity and securing economies in intermediate product, raw material and fuel-energy resources and the successful realization of the republic's food program; and to ensure the extensive enlistment of the republic's inventors and efficiency experts in the nationwide movement for an increase in production efficiency and work quality devoted to a fitting greeting of the 60th anniversary of the formation of the USSR.

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